THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

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GAS PURIFICATION
BY
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Tubes and Fittings for Gas, Steam, Water, and Hydraulic purposes, plain, galvanized, white enamelled inside, or coated by Dr. Angus Smith's process, or oxidized by Professor Barff's patent process. Gas-fitters tools, brass cocks, &c.
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Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
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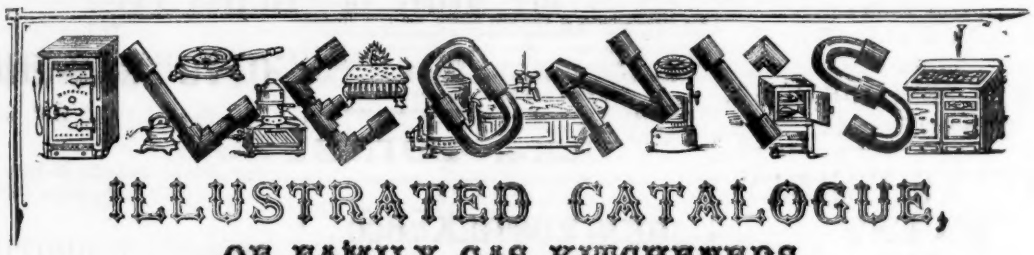
Their Coal is in use in the Salford, Stafford, Bolton, and other large Gas-Works in England, Ireland, Wales, and Abroad, giving in practical working 10,300 feet of 17-candle Gas, and 15 cwt. of superior Coke per Ton of Coal.



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This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention. It has been in constant successful use for five years, and is now in operation in upwards of fifty places.

Prices, fitted and fixed complete, exclusive of Valves and Connections; all foundations and unskilled labour required in erection to be provided by the Gas Company:—

Quantities to pass in cubic feet per 24 hours	100,000	250,000	500,000	750,000	1 million	1½ million	2 million	3 million	4 million
Price each	£30	£50	£70	£95	£120	£165	£200	£280	£360

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THE UNVARYING WATER-LINE GAS-METER,

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STATION-METERS OF ALL SIZES, with PLANED JOINTS;

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Most Effectively and Economically restores this waste *ad infinitum*.

The Patentee having devoted more time and attention to this subject than perhaps any other person living, is now in a position to recommend the adoption of this process to Gas Companies and Corporations with the utmost confidence in its practical utility, convenience, and economy. 1st. It restores the spent Lime at from one-third to one-half its original cost, apart from its undoubted convenience and the economy of space. 2nd. There is practically no limit to the duration of the Lime. 3rd. The cost of apparatus for the introduction of the process is very moderate and exceedingly durable. 4. The Patentee supplies special bricks and castings, erects and proves the process on the most favourable terms.

The process, in operation, may be seen at the Corporation Gas-Works, Paisley, where the Lime has been restored 120 times. Inspection is cordially invited.

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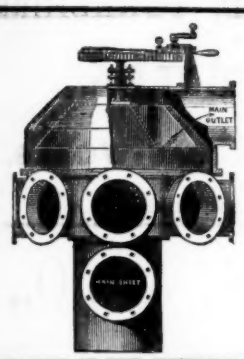
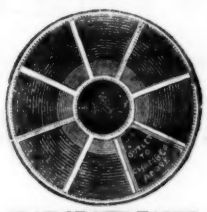
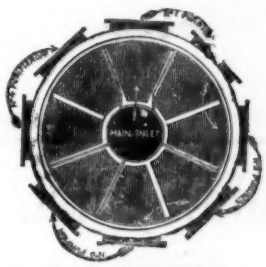


ELEVATION OF THE CENTRE-VALVE.



PLAN OF THE VALVE.



PLAN OF THE BODY.

These PATENT CENTRE-VALVES are the most perfect and certain means for working Purifiers on the system of three in action, and one out of action. The Valve itself is protected from all injury inside the safety cover. The working of the Valve is so easy, and so governed by the stop-catch movement, that the Purifiers can be instantaneously changed in the dark as well as in daylight. They are scraped perfectly true, metal to metal, the facings heretofore exposed are always covered, and there is nothing more reliable, certain, and durable in a gas-works. By their use the floor of the Purifying-house is clear and level; the Valve and all connexions being beneath the floor, out of the way of working. A considerable improvement and saving is effected in the cost of the connecting-pipes.

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LIMITED,

ARE NOW PREPARED TO SUPPLY AND ERECT THEIR PATENTED MACHINERY FOR

CHARGING AND DRAWING GAS-RETORTS,

And to enter into arrangements with GAS COMPANIES for its use upon moderate terms of Royalty.

The Patented Machinery has secured the approbation of all Engineers who have visited the MAIDSTONE GAS-WORKS, *where it is in full operation, and may be inspected at any time on application to the Manager.*

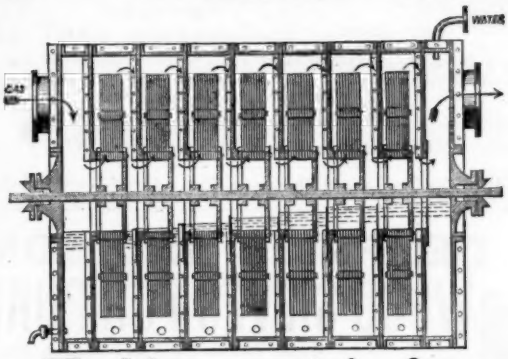
The advantages attending its use are—

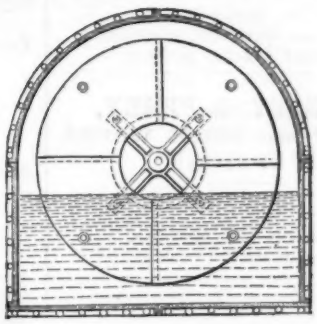
INCREASED VOLUME OF GAS PER TON.—INCREASED YIELD PER RETORT.—INCREASED BULK OF COKE FOR SALE.—REDUCTION IN LABOUR AND LESS DEPENDENCE ON SKILLED STOKERS.

A Pamphlet containing a description of the Machinery, and Copies of Reports on the working of the same, &c., will be forwarded on application to the MANAGING DIRECTOR, Maidstone. Communications may also be addressed to the Consulting Engineer, R. P. SPICE, Esq., M. Inst. C.E., 21, Parliament Street, London, S.W., or to the Engineer and Analyst, F. W. HARTLEY, Esq., A. Inst. C.E., 55, Millbank Street, London, S.W.

KIRKHAM, HULETT, & CHANDLER, LIMITED.

PATENT "STANDARD" WASHER-SCRUBBER COMPANY.





These Machines contain from 3200 feet to 65,000 feet of Wetted Surface.

The Special Merits of this Washer are as follows:—That it is not necessary to reduce the temperature of the gas to 60°, or thereabouts, to make it effective; and that as no tar is retained in it, the illuminating power is not reduced as in Tower Scrubbers. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas as it ascends. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine, as well as a very large quantity of carbonic acid and sulphuretted hydrogen. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan.* 14, 1879.

Gentlemen,—In reply to your inquiry, I am pleased to say the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, it takes out every particle of Ammonia, while purifying more Gas than it was intended to do. I enclose particulars of a week's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c., (Signed) JOHN CLARK, Engineer.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 *feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—*

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 7	11	9	7	5½	3¾	3	1¾	1¼	½	0	10 Gallons.	59,000	Nil.	74°	66°	31°	25	23½	5
„ 8	9½	7½	6	4½	3	2	1	¾	½	0	10 „	78,000	Nil.	73°	61°	31°	28	26½	4½
„ 9	11	9	7	5	3¾	2½	1¼	1	½	0	10 „	82,000	Nil.	74°	67°	33°	27½	25½	5
„ 10	10¾	8½	6¾	5	3¼	2¼	1½	1	½	0	10 „	66,000	Nil.	76°	64°	28°	28½	27	5
„ 11	12½	10	7¾	5¾	4¼	3¼	1¾	1¼	½	0	10 „	61,000	Nil.	73°	64°	27°	26½	25½	5
„ 12	11	8¾	6¾	—	—	—	1¼	¾	½	0	10 „	39,000	Nil.	74°	64°	27°	26½	25½	5
„ 13	13	10¾	8¼	6	4¾	3½	2	1½	¾	0	10 „	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May* 23, 1879.

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March* 6, 1879.

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				10	9	8	7	6	5	4	3	2	1	
64,000	Inlet	2·00	2·00	158·8	72	57	21	4¼	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·05	0·6	0·3	0·15	0·1	63
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

Messrs. KIRKHAM and HERSEY. *The Leeds Corporation Gas-Works, Meadow Lane, Aug.* 14, 1879.

Gentlemen,—In reply to your inquiry of yesterday's date, I have pleasure in stating that the item appearing as income derivable from Ammonia in my estimate of revenue for current year is not an exaggeration. Our average income from Ammonia is 2s. 8d. per ton of coals carbonized, but at the works where your invention is in use we derive not less than 3s. per ton. Since the introduction of efficient Scrubbers at our works the greater yield of this product (now twice as valuable as coke to us) is such that the cost of Apparatus for its extraction can be wholly paid for out of from nine to twelve months gains. I am, Gentlemen, yours faithfully, (Signed) H. WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *Woolwich Equitable Gas Company, Engineers Office, Nov.* 1, 1879.

Gentlemen,—In answer to your inquiry respecting Washer erected here in September last, and which has been working here constantly since Oct. 1, I beg to say that it is working very satisfactorily. We sell over 24 gallons of 10 oz. liquor per ton of coal carbonized, and depend upon your Washer to extract all Ammonia, which it does satisfactorily, not leaving a trace of free Ammonia at the outlet. It takes little power to drive it, and the difference of pressure between inlet and outlet is scarcely noticeable, being less than half an inch. I consider it a very valuable machine, and have little doubt that it will pay for the outlay in a very short time. I shall be pleased to show it to any one that may be in want of such a machine, when they can see its capabilities themselves.—I am, Gentlemen, yours faithfully, (Signed) W. WHITE, Engineer.

Messrs. KIRKHAM and HERSEY. *Heywood Local Board Gas-Works, Hooley Bridge, Heywood, Dec.* 1, 1879.

Gentlemen,—In reply to your favour of the 28th ult., I beg to state that the Scrubber is at work, and doing well. I shall be glad to show it to any inquirers.—Yours truly, (Signed) EDWIN BUCKLEY, Engineer.

Messrs. KIRKHAM and HERSEY. *Phœnix Gaslight and Coke Company, Office, Greenwich, S.E., Dec.* 19, 1879.

Gentlemen,—In accordance with my promise that I would inform you as to the working of the "Standard" Washer erected by you here in June last, I now write to say that we are passing through it 100,000 cubic feet per hour (the quantity for which it is made) direct from the Condensers, "bye-passing" the whole of our Scrubbers, which, not being needed, have been standing still since the "Standard" Washer was put in use. It seems as though the Washer more effectually removed the Ammonia when taking the full quantity of gas than less; as, at the present time, at the sixth chamber (there being eleven in all) not a trace can be discovered either by turmeric or acid litmus paper. The difference in pressure between inlet and outlet is only ten-tenths of an inch. I need scarcely say, after the above, how perfectly satisfied I am. (Signed) P. J. WATES, Engineer.

For further particulars and testimonials, address Messrs.

KIRKHAM, HULETT, & CHANDLER, LIMITED, { 59 & 60, Palace Chambers, Bridge St., Westminster, London, S.W.

C. & W. WALKER'S
WOOD PURIFIER SIEVES,

Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

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FINSBURY CIRCUS, LONDON.

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Manufacturers for Home and Export.
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And Every Description of Best Fire-Bricks.

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Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.
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SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

ESTABLISHED IN 1860.
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GATESHEAD-UPON-TYNE.
Are the Sole Manufacturers of
Archer's Patent Hoists,
ALSO OF
Archer's Patent Stone Breaker,
AND OF
Archer's Patent Ore Crusher & Pulveriser,
The last-named Machine (without the Pulveriser) makes the best and most durable Coke Breaker.

GEORGE'S
Patent Gas Calorigen,
A STOVE FOR
WARMING AND VENTILATING.
RECOMMENDED BY DR. RICHARDSON.

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STEEL OF ALL DESCRIPTIONS,
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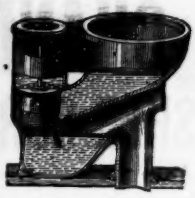

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PATENTEES AND INVENTORS OF THE
TRAPLESS, THE D TRAP, AND EDDYSTONE CLOSETS.
Also the New
ECLIPSE COMBINATION CAST LEAD TRAP,
The Price will be half of the old-fashioned D Trap, it being cast all in lead, without a Joint.
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SCRUBBERS FILLED WITH BOARDS,
On our approved principle, for the extraction of Ammonia.
Prices on application. References to First-Class Engineers.
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GLOBE METER-WORKS, OLDHAM,
MANUFACTURERS OF
WET & DRY CONSUMERS GAS-METERS,
OF THE HIGHEST EXCELLENCE ONLY;
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ALSO LICENSEES AND MANUFACTURERS OF
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ROUND STATION-METERS,
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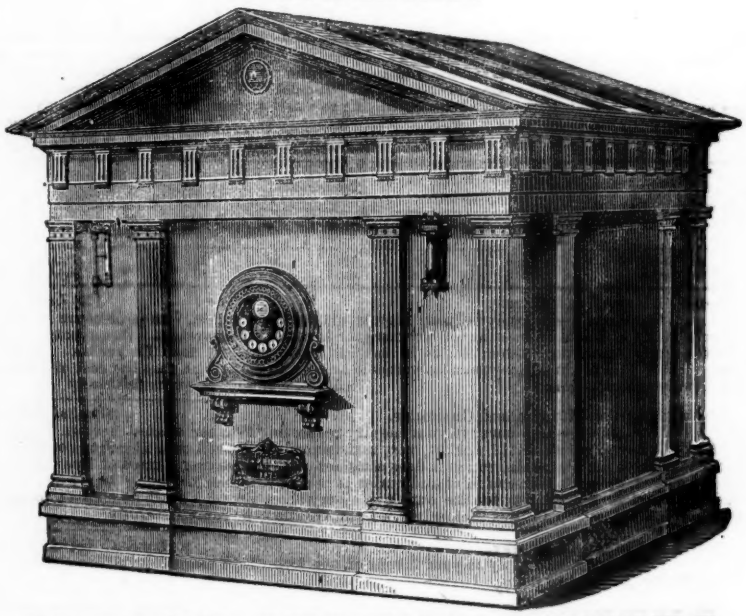

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WITH PLANED JOINTS.
GOVERNORS, GAUGES, INDICATORS, MAIN COCKS, &c.
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Home and Foreign Orders promptly attended to.
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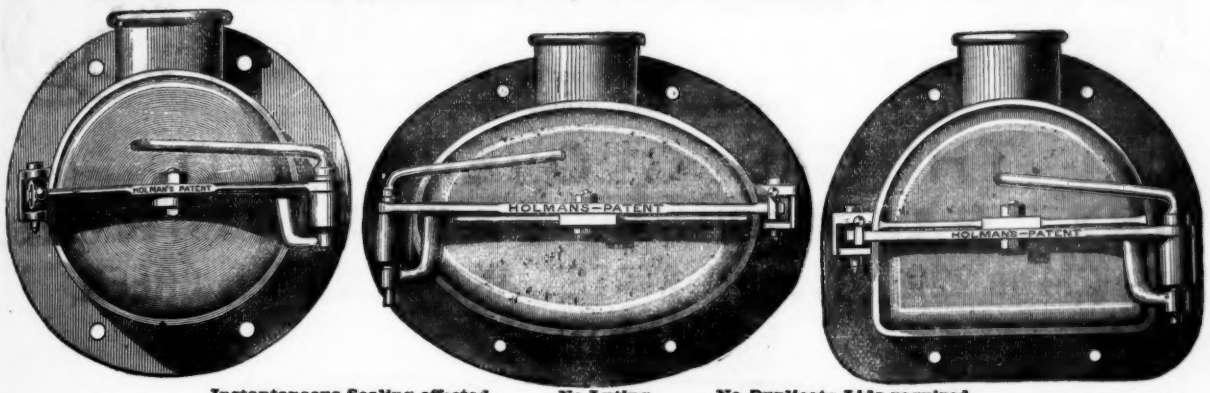
SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and Self-Sustaining Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.
Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

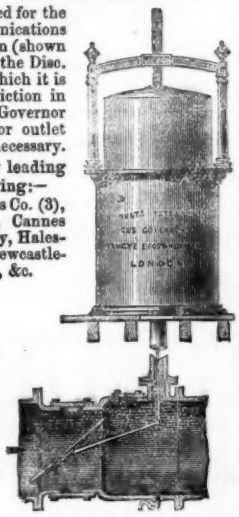
Morton's Patent Retort-Lids are in use in nearly all the Principal Gas-Works in the United Kingdom and the Colonies; also on the Continent and in the United States of America. They are now made of the

SAME FORM OR SECTION AS THE RETORT. (See Illustrations above.)

Engineers preparing Specifications of New Works will be furnished with Dimensions of Stock Patterns, together with Approximate Weight and other data on application.

HUNT'S
EQUILIBRIUM DIRECT-MAIN GAS GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight & Coke Co. (19), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Leicester, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

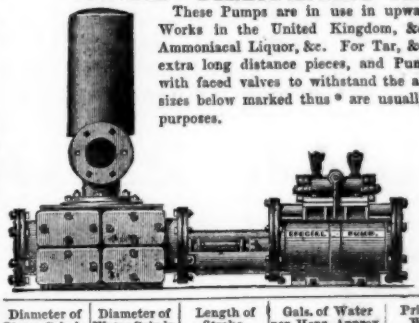
MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

Yours truly,
(Signed) JOHN JOHNSON.

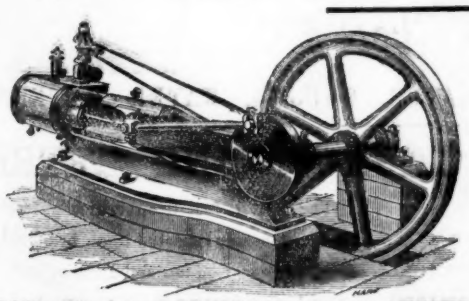
THE
"SPECIAL" DIRECT-ACTING STEAM-PUMP.

These Pumps are in use in upwards of one hundred Gas-Works in the United Kingdom, &c., pumping Water, Tar, Ammoniacal Liquor, &c. For Tar, &c., they are provided with extra long distance pieces, and Pumps are entirely of iron, with faced valves to withstand the action of the liquid. The sizes below marked thus * are usually kept in stock for these purposes.



The quantities delivered of Tar should be taken about two-thirds that of water.

Diameter of Steam Cylndr.	Diameter of Water Cylndr.	Length of Stroke.	Gals. of Water per Hour, Approx.	Prices for Water.	Prices for Tar and Ammoniacal Liqr.
*3 in.	1¼ in.	9 in.	450	£16 0 0	£17 0 0
*4 ,,	2 ,,	9 ,,	815	18 0 0	19 0 0
*5 ,,	2½ ,,	12 ,,	1,250	21 0 0	22 10 0
*5 ,,	3 ,,	12 ,,	1,830	22 10 0	24 0 0
*6 ,,	3 ,,	12 ,,	1,830	25 0 0	26 10 0
*6 ,,	4 ,,	12 ,,	3,250	30 0 0	31 10 0
6 ,,	5 ,,	12 ,,	5,070	35 0 0	36 10 0
*7 ,,	5 ,,	12 ,,	5,070	40 0 0	41 10 0
7 ,,	6 ,,	12 ,,	7,330	45 0 0	46 10 0
*8 ,,	6 ,,	12 ,,	7,330	50 0 0	52 0 0
10 ,,	6 ,,	12 ,,	7,330	60 0 0	62 10 0
10 ,,	8 ,,	12 ,,	13,000	75 0 0	77 10 0



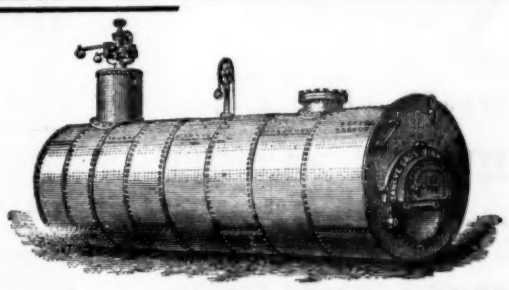
TANGYE'S HIGH-PRESSURE STEAM-ENGINE,

NEARLY 4000 IN USE.

The Design, Workmanship, and low prices of these Engines have called forth universal approval.

Nom. H.P.	2	3	4	6	8	10	12	14	20	25
	£28	£37	£44	£68	£86	£111	£122	£133	£185	£215

Including Governor and Feed Pump. Variable Expansion extra.



CORNISH, LANCASHIRE, "THE KESTERTON," VERTICAL, AND MULTITUBULAR STEAM-BOILERS OF SUPERIOR QUALITY ALWAYS IN STOCK.

This Department having been greatly extended and furnished with the most approved Boiler-making Machinery and Tools, T. B. & H. are prepared to supply all kinds of Steam-Boilers with great facility at lowest current prices.

Also Makers of IMPROVED HYDRAULIC HOISTS, TRAVELLERS, CRABS, CRANES, PULLEY BLOCKS, HYDRAULIC AND SCREW LIFTING JACKS, LATHES, PUNCHING AND SHEARING MACHINES, And all other Descriptions of Tools, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, &c., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters bv the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

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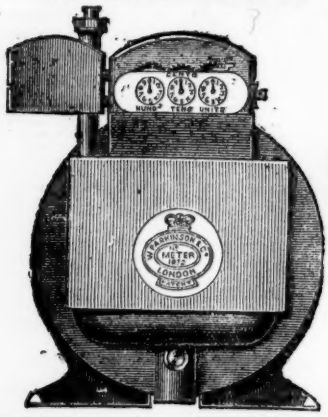
THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,



(ESTABLISHED 1816,)

MANUFACTURERS OF

WET & DRY METERS,

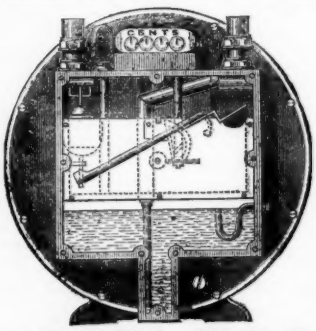
STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

CONTENTS.

	PAGE
Circular to Gas Companies:—	
Gas Undertakings and the Change of Government	665
The Illuminating Power of Mr. Edison's Horseshoe Lamp	665
The Lancaster Corporation and their Gas Undertaking	665
The Meeting of the North of England Gas Managers Association	665
The Meeting of the West of Scotland Gas Managers Association	665
Visit of the Students of the Institution of Civil Engineers to the South Metropolitan Gas-Works	666
Water and Sanitary Notes:—	
The Metropolitan Water Question	666
Introduction of the Constant Supply in Exeter	666
Are Sewage Farms Profitable?	666
Leading Articles:—	
The Water Wrangle	667
Effluvium Nuisances	668
Warner's Improvements in Machinery and Apparatus for Charging and Drawing Gas-Retorts	670
Communicated Article:—	
Dr. Adams's Gas Stove	671
Correspondence:	
Pumping Gas at Beckton	672
The Bray Lantern and Burner and Mr. Sugg	672
Legal Intelligence:—	
High Court of Justice—Exchequer Division—Humber v. The Topsham, Woodbury, and Lympstone Water-Works Company	672
Miscellaneous News:—	
Brisbane Gas Company	666
Large Gasholder Tank at the South Metropolitan Gas-Works	675
The Proposed Gas-Apparatus Exhibition in Glasgow	676
Edison's Horseshoe Lamp v. Gaslight	676
North of England Gas Managers Association	676
West of Scotland Association of Gas Managers	678
Bridgwater Corporation Water Supply	678
Metropolis Water Supply	679
Trade Reports	682
Pumping Gas at Beckton	682

TO CORRESPONDENTS.

No notice can be taken of anonymous communications. Whatever is intended for insertion, must be authenticated by the name and address of the writer; not necessarily for publication, but as a guarantee of good faith.

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, MAY 4, 1880.

Circular to Gas Companies.

SOME years ago, when Mr. Chamberlain, M.P., was explaining to the Birmingham Town Council the terms of purchase of the Birmingham Gas and Water Companies undertakings, and the probable results of the bargain, he made his statement in so lucid a manner that we ventured to prophesy that whenever a Radical Government came into office he might possibly be Chancellor of the Exchequer. Our prophecy has only been half fulfilled. Mr. Chamberlain has entered the Liberal Cabinet, though not as Chancellor of the Exchequer. He is President of the Board of Trade—a fact which we recommend Gas Companies to notice. Mr. Chamberlain's proclivities are altogether antagonistic to the interests of Gas and Water Companies. He believes—and we are certain that he is conscientious in his opinions—that gas and water undertakings should not any longer remain in the hands of commercial bodies, but should pass as quickly as possible into the possession of Local Authorities. He has a few other crotchets, one of which is that when a Local Authority contracts a debt it should remain a charge upon all posterity; but perhaps being a year or two in office with colleagues who advocate sinking-funds will bring him round to the opinion that a debt incurred should be wiped out as quickly as circumstances will admit. If we take the case of Birmingham, it is quite certain that the ratepayers will be benefited by every reduction in the charges for interest. Supposing the whole debt wiped out, the Corporation would remain in possession of the undertakings, and be practically free from further charges on the undertakings, unless they contracted fresh debts. They would necessarily do so, and therefore a continuous responsibility would be entailed. This certainly ought to satisfy Mr. Chamberlain. He has practically a permanent debt to meet, but of a kind for which he has no respect. He would borrow a large sum and expend it; borrow more, and add to the debt, and so forth; but we may take it that an inevitable day of reckoning must arrive. There is a class of advanced political economists, to which, we believe, Mr. Gladstone belongs, who would hasten to pay off the National Debt while the full supply of coal is to be obtained. When the payment of that Debt is considered, we may just as well look to minor matters, and inquire how the debts of Local Authorities are to be discharged. A Local Authority with a gas and water undertaking is in a very convenient position to assume a state of solvency; but with constantly accumulating charges, it seems perfectly clear that such a condition of things cannot long exist, unless the debts be gradually reduced, as they must be, by means of a sinking-fund.

Mr. Edison, it would seem, has not gone to California to extract gold from poor quartz any too soon for his reputation as an electric light inventor. Our readers will see in another column an abstract of a report from Professors Morton, Mayer, and Thomas, which clearly demonstrates that the horseshoe lamp is a striking failure when compared with gas. One of these lamps actuated by $1\frac{3}{8}$-horse power and the Brush or Siemens machine fails to give a regular light of more than ten candles. Gas of a known quality consumed at the rate of five feet per hour, produced a light which cast the Edison horseshoe into the shade. The expenditure of coal for the production of $1\frac{3}{8}$-horse power is fixed at five pounds per hour. Now, one pound of gas coal will produce five feet of gas, besides a large quantity of coke and other residuals. Leaving residuals out of consideration, five pounds of gas coal are equal in light-producing power to five pounds of steam coal. Thus we arrive at a knowledge of the fact that equal quantities of coal are considered equivalent in illuminating results. The reporters from whom we quote are perfectly satisfied that the advantage of illuminating power and low charges, therefore, decidedly lies with gas. We believe it will always be found so. We await, with much interest, reports from some of our public authorities; but we believe, as we say, it will be found that gas can fairly compete, in illuminating power and cost, with electricity.

The Lancaster Corporation are still hesitating to complete the purchase of the undertaking of the Gas Company who have up to this time supplied their limits. Their hesitation seems to be the result of some small meanness existing in the Council. When the Company parted with their undertaking, it was well known that their storeage room wanted enlarging, and it was estimated that from £10,000 to £15,000 would be required for the excavation of tanks and the erection of additional gasholders. It seems perfectly certain that the extensions are urgently required; but the Town Council hesitate to commence the necessary erections, and some members now grumble that the purchase-money was ever agreed to be paid. It is quite true that the works may not, at the present moment, be adequate to supply the wants of a dark winter's day; but if an expenditure of £10,000 would have made the then plant adequate for the requirements of the borough, it would simply have amounted to this, that the Corporation would simply have had to pay £15,000 more. Now the Corporation have the opportunity of completing the works themselves, and so of saving a considerable sum; but they will not see it. However, the business, we take it, is settled. Lancaster has a gas undertaking, and under proper management it will prove highly remunerative. It paid the Gas Company well, and there is no reason why, when enlarged, it should not pay the Corporation better; and we have no doubt the ratepayers, if they can only secure good management, will soon rejoice over the success of their gas-works.

The sixth half-yearly meeting of the North of England Association of Gas Managers was held at Newcastle-on-Tyne on the 24th ult., and the principal business done was to pay a visit to the Jarrow works of the South Shields Gas Company, in order to see Mr. Warner's apparatus for retort drawing and charging in operation. The apparatus was exhibited and described by its inventor, and it was shown that the best effects resulted from its use. Our readers who have not seen it in actual working will be able to judge of its merits from the description and drawings we give to-day.

The eighth annual general meeting of the West of Scotland Association of Gas Managers was held at Hamilton on Thursday last, under the presidency of Mr. R. Mitchell, of Coatbridge, and we are sorry to see that a proposition for the amalgamation of this Association with the North British Association of Gas Managers has fallen through. We will not say that there can be too many Gas Managers Associations; but we feel satisfied that a few concentrated ones are best adapted to promote the interests of the science of gas-making. The President delivered an interesting address, in which he mentioned that since the electric light dawned on the world, Gas Managers had been more than ever active in their endeavour to cheapen the price of gas to the consumer. It is somewhat curious to see a Gas Manager acknowledging a debt of gratitude to the electric "scare;" but it was very properly done by Mr. Mitchell. The fact is, the electric light has stirred up Managers to find improved systems, first as to the setting of retorts, and then as to the application of heat. Siemens's regenerative furnace has come to be looked on with more favour. We shall probably find it brought into frequent use. The new systems of drawing and charging retorts by machinery are calculated to save much labour, and consequently much cost to Gas Companies; and we look for very favourable results from the use of these apparatuses. Mr.

Niven promises a simplified table, which will enable Gas Managers to reduce gases to uniform temperatures and pressures without any tedious calculation. We did not know that tedious calculations were required; but if any simplification can be effected, by all means let us have it.

Those students of the Institution of Civil Engineers who accepted the invitation conveyed to them by Mr. G. Livesey, M.I.C.E., to visit the works of the South Metropolitan Gas Company, to which a brief allusion was made in last week's JOURNAL, are not likely, we think, to regret the two hours they spent in so doing. Under the personal guidance of their host and his brother, Mr. F. Livesey, the party of gentlemen who assembled at the works in the Old Kent Road last Friday afternoon were afforded an opportunity of witnessing the process of gas-making under the best possible conditions. The various details in connection with the production, purification, and storeage of coal gas, which has now come to be regarded as one of the necessaries of life, were concisely explained as each branch of the entire process came under notice. Of course the centre of attraction was the extensive gasholder-tank which is now in course of construction on the works, and of which a few particulars are given in another column, and it must have been gratifying to all connected with this undertaking to witness the great interest displayed in it. It is not to be supposed that the information acquired last Friday will be immediately or specially serviceable to all the gentlemen who then accompanied Mr. Livesey round the works; but it will, nevertheless, be to that gentleman's credit that he afforded the students of the important Institution of which he is a member, an opportunity of making themselves more closely acquainted with the particular branch of industry and civil engineering in which he has distinguished himself.

Water and Sanitary Notes.

THE representatives of the London Local Authorities were busy last week in considering the Water Supply of the Metropolis. The Vestry delegates held a meeting on Friday, at which a few members of Parliament assisted, when it was resolved to apply to the Government for advice and assistance in the matter. Sir R. Cross's Bill was unanimously condemned, but there seemed a general consensus of opinion that something might be effected, if only the new Government would now take the initiative. Should the Government take it earnestly in hand, and should the measure they propose meet with the approval of a strong Committee, doubtless something may be done. We are at the beginning of May, and it will be another fortnight before Parliament settles into working order. Thus it is scarcely possible that any progress can be made with a Metropolitan Water Bill. There is, as we have said before, a great deal to be urged in favour of Sir R. Cross's Bill, and perhaps the best thing Mr. Gladstone could do would be to take it as it now stands and send it to a Committee; as this would save a world of trouble, and the work would only have to be done over again next year, as, in any case, it is certain to be. We do not discern a unanimity of feeling on the part of the Vestry delegates, further than going to the Government for advice and assistance. No one member seems to have an idea of what will be required when the Water Companies are bought up. The valuations made by Sir R. Cross's assessors fairly represent the water undertakings as they stand, and as they will be twelve years hence. Thus we have a valuation by eminent actuaries as to the present and prospective value of these undertakings. The growth of the Metropolis, although somewhat irregular, is steady. We know perfectly well to what extent the Water Companies will be required to extend their supplies; but the question to-day is in what way they should be compelled to limit their charges for the supply of water. A Suspensory Act is talked of, which would take away from the Companies the power to add to their rates on the re-valuation of Metropolitan house property. Suspensory Acts are not unknown, but this, we believe, is the first which is proposed to step in between Water Companies and the exercise of their legitimate rights. Of course, many opinions will be entertained as to the duty of the Government under the circumstances. There are enthusiasts who would drive them forward in a headlong course, which could only end in a signal defeat.

That Mr. Fawcett should be a member of the Government at this conjuncture is an ominous fact. How far, now that he occupies an official position, he will be inclined or induced to push on with the schemes with which he first took up, is extremely doubtful. We rather think he will find in his official duties at the Post Office, small as they may be, sufficient to divert his attention from all assaults on the Water Companies. He would, perhaps, be prepared, but he has now a ready excuse—the matter is out of his hands, and must be passed over to the whole Cabinet. We can hardly suppose that Mr. Gladstone has any decided views on the subject, and we may feel satisfied that Sir W. Harcourt will have no views at all. Thus, then, the matter remains. The reconsideration of the Water Question must be relegated to a Committee of the House of Commons. But who is to prepare the Bill for their consideration? We have many times suggested that Sir R. Cross's Bill may properly form a convenient basis for new legislation. We are perfectly aware that while it meets the views of the Water Companies, it does not altogether suit the ideas of the ratepayers; but there are always two parties to a bargain—the one is a seller, the other is a buyer—and each one wants his own terms.

The Metropolitan Board of Works have, we will not say made a *fiasco*, but they have entirely failed to appreciate the exigencies of the situation. Like the Vestry delegates, they have resolved on going to the Government for assistance and advice upon the Water Question, and this we can only hope they will obtain. When we say this we must not be considered to express any opinion as to the policy of the proceeding. We should prefer to see some more independent course followed. If ever the Metropolis is to have full and perfect control over its own water supply, it must be effected through the unaided exertions of a strong Municipality. Mr. Chamberlain never thought of applying to the Government for advice and assistance when engaged in the purchase of the Birmingham gas and water undertakings. He went straight to the point, met the Companies, and soon arranged terms with them. Doubtless, if Mr. Chamberlain were at the Home Office, instead of at the Board of Trade, he would soon come to an arrangement with the Metropolitan Water Companies. We must wait, however, a few weeks, to see what turn events will take. The question will probably be brought forward in some shape or other at a very early date, and we shall then have Mr. Gladstone's views of the matter. In the meantime, it is very curious to notice how very little enthusiasm is shown on the subject by the general public. The agitation is confined within very narrow limits, and perhaps if left alone the matter would soon be forgotten.

The Corporation of Exeter have decided on furnishing a constant supply of water in the city, but they are going cautiously to work—introducing it into one district at a time, to see how it answers, and whether the ratepayers can be trusted with the necessary fittings. Of course there is a great deal of talk about regulations, and some members of the Council evidently consider that some of those prepared by the Water Committee are too stringent. For instance, it was seriously proposed that a consumer should not be allowed to turn off the stopcock outside his house, if the pipe within the house had burst, without the previous sanction of the Water Committee. This was thought "too good," and the Council rejected it. Nevertheless, it will be found highly necessary to have somewhat stringent regulations if the water is to be supplied at any considerable pressure.

It cannot be said that all sewage farms are unprofitable. There is, for instance, one of 207 acres at West Derby, which has produced a profit of £230 in the six years during which it has been worked. Of course it will be said that sewage farms are not primarily intended to produce profits; so long as the sewage is got rid of, and no harm is done, it is considered all well. Still, it is a grievous disappointment to many, who have been so egregiously misled by Mr. Mechi and others, to find that, after all the promises that have been made, more or less complete failure has resulted from practical working.

BRISBANE GAS COMPANY.—The report of the Directors of this Company for the six months ended Dec. 31, 1879, stated that during this period the management was carried on under circumstances of unusual difficulty and anxiety, arising from the necessity for a change in the professional management. For these reasons the erection of the South Brisbane gasholder, and the carrying out of many alterations, additions, and repairs, were delayed until the new Engineer's arrival. To meet the necessary expenditure, the Directors, after recommending that the usual dividend at the rate of 10 per cent. per annum, with bonus, be declared, considered it advisable to carry forward to next half year a larger sum than usual. It was decided to increase to 20 per cent. the discount allowed for prompt payment of accounts, to take effect from Jan. 1, 1880. The profit and loss account showed that in the period reported on £9325 was received from the sale of gas; rent, £62; licence fees, £4; balance brought forward, £41—total, £9432. There was expended in the manufacture and distribution of gas, and management, £3889; rates and taxes, £31; interest and discount, £1471. These sums, with the bad debts, amount written off for depreciation of plant, and the reserve, made a total of £6582, leaving a balance of £2850.

THE METROPOLITAN WATER WRANGLE.

Mr. Selway's proposition in reference to the London Water Supply, brought forward at the meeting of the Metropolitan Board on the 23rd ult., was adopted by them last Friday, after it had been so modified as to avoid all appearance of a proposal to seek for an Act of Parliament. As matters now stand, it is referred to the Works and General Purposes Committee to consider and report as to the necessity and means of improving the Water Supply of the Metropolis, by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon. The Chairman of the Board, on being interrogated by Mr. Munro, stated that in order to obtain the Indemnity Bill, he had promised, so far as he could pledge the Board, that for the future no Bill dealing with the Water Supply of the Metropolis should be introduced by the Board "without the consent of Her Majesty's "Government." This final clause in Sir James Hogg's undertaking was referred to by Mr. Selway as showing the loophole through which the Board might once more get into Parliament with a water scheme; and, if we understand Mr. Selway aright, it appears that this gentleman has some hope that if a conference should take place between the Metropolitan Board and the Government, the Board may find itself in a position to deal with the Water Question by a scheme of its own.

Concurrently with the discussions at the Metropolitan Board, we have the meetings of the Vestry delegates at St. Martin's-in-the-Fields, under the chairmanship of Mr. E. J. Watherston. On Friday these local dignitaries had the benefit of the presence of several Members of Parliament; but the sole result of a discussion which lasted two hours was the adoption of a resolution—"That the delegates of the various "Vestries and District Boards of the Metropolis seek an early "interview with the Premier, the Home Secretary, or other "Minister, to urge the passing of a Bill without delay, sus-"pending until the end of the next session of Parliament the "power of the Water Companies to augment the charges "made by them respectively in the Metropolis." The delegates might, with almost equal propriety, have resolved on asking the Government to introduce a Bill restricting the Water Companies from making any addition to their dividends. As we remarked on a former occasion, the proposal is nothing less than a request that the Companies shall in many cases be compelled to base their charges on something less than the annual value of the premises to which they furnish a supply. That Mr. Torrens should advise the delegates to pass a resolution of this kind shows how little that gentleman understands a question on which he has, nevertheless, made himself prominent. Mr. Beal endeavoured to infuse a little common sense into the meeting respecting this part of the subject, but with small success. He so far succeeded as to make some gentlemen understand that the Metropolis Valuation Act of 1869 merely served to assist the Companies in ascertaining the annual value of house property, the right to charge on such a basis being quite independent of the Act in question. But the resolution of the delegates, as amended and approved by Mr. Torrens, goes to sweep away the powers conferred by the Water-Works Clauses Act of 1847, and by the special Acts of the several Companies. This is to propose a despotism pure and simple, and for the sake of vested interests in general we may well congratulate the community that there is a considerable gulf between St. Martin's and St. Stephen's.

The numerous meetings and conferences of the Vestry delegates thus end in nothing. Had these gentlemen been wise, they would have gone with Mr. Watherston and Mr. Beal in asking that the Bill of the present Sir Richard Cross should go before a Hybrid Committee, who could thoroughly investigate the measure and report upon its merits. Although the Committee could not alter the terms of the Bill, it was distinctly intended, and necessarily so, that they should inquire into the financial part of the scheme, in order to see whether it was such as Parliament ought to approve in the interests of the ratepayers. Having, as they fancy, got rid of the Bill, the delegates assembling at St. Martin's wish the Government to keep the Water Companies just where they are until some new scheme can be settled. In fact, the Companies are to be bound hand and foot, until they can be conveniently hanged. Mr. Torrens, who spoke of London as a "town," and yet as "ten towns on the banks of the Thames," declared that "the town at large" was "sick of the present system "in regard to the water supply, which had grown to the "magnitude of a public scandal." The member for Finsbury denounced the Bill of Sir Richard Cross, together with all the laws and regulations affecting the Water Companies, as well as the Water Companies themselves. But he was determined to vote against any scheme for transferring either water or gas undertakings to a Government department. Mr. Torrens looked forward to the reconstruction of the government of London, when the water supply would be handed over to the municipal bodies thus created. The delegates cheered the proposal, but one of their number suggested that with this prospect before them it was desirable to have a Suspensory Act which should operate for a longer period than until the end of the next session. Mr. Torrens replied that this "was the usual form." We venture to think it will be something very "unusual" if Parliament passes any such Act as the one proposed. Mr. Beal was curious to know whether Mr. Torrens had any experience of such an Act being passed, unless it might be in the case of the Irish Church. Mr. Torrens was obliged to own that "the question "raised by Mr. Beal was encumbered with many difficulties." Suspensory Bills had been passed by Parliament, but they were in the nature of public Bills. It might, therefore, be necessary in this instance to suspend or modify some of the rules of the House. But Mr. Torrens declared that, *nolens volens*, the Government "must do it." "If there were no "precedent, the Government must create a precedent, because "the state of affairs in regard to this matter was itself with-"out precedent." So the Gordian knot was cut, and the delegates were satisfied. As for Sir Richard Cross's Bill, Mr. Torrens would not ask the Government to withdraw it. Such a request would be a mistake. The Bill did not exist; this was a new Parliament. Mr. Beal rose from his seat at this statement, and inquired whether Sir Richard Cross had not obtained the passing of an Order keeping all Bills alive. Mr. Torrens explained that the Order of the House merely provided that the Bills "might be introduced," despite the Standing Orders which otherwise would block their way.

We think it well that the "wild words" of Mr. Torrens should be carefully weighed, wild as they may be. Mr. Torrens commenced by stating it as his experience that "it "was much easier to say sharp things and strong things than "to say wise things." Of this he appears to have furnished proof *in propriâ personâ*. The delegates were addressed in a very different spirit by Mr. Coope, who avowed himself as a Director of a London Water Company, but who appealed to the judgment and good sense of the delegates, instead of seeking to play upon their prejudices and excite their passions. Professor Thorold Rogers acknowledged that he was not very familiar with the subject, but he objected to the terms embodied in the Water Bill, and proposed that the delegates should seek for the appointment of a Royal Commission to define a financial basis of purchase. Mr. Firth, the member for Chelsea, objected to the price which the Government Bill proposed to pay to the Companies, and founded his objection on the fact—as he put it—that the present water supply was not to be the "final one." Mr. Firth appeared to have a notion of getting a new supply, it being his contention that the water taken from the Thames was polluted with the sewage due to a population of 900,000 persons. Mr. Firth did not state on what authority he obtained this reckoning. Later in the proceedings one of the delegates complained that the sewage of Oxford contaminated the Thames, to which statement Professor Thorold Rogers took exception. We believe the Thames Conservators would differ widely from Mr. Firth concerning the extent to which town sewage enters the river above London. But the member for Chelsea wished for change, and adopted the idea of a Suspensory Bill in the interval. He also hoped for municipal institutions.

Pending the settlement of the government of London, it appears that the Water Companies are to be crystallized where they stand. "As you are" is to be the word of command, until they are ordered to march off the ground altogether. Such, at all events, is the procedure which certain gentlemen contemplate; and it will be observed that these enterprising and zealous reformers also have their eyes on the Gas Companies. It has been said that the Government Bill meant "patronage." The objection may be valid, so far as it goes; but will nobody enjoy the sweets of patronage supposing the water supply to be transferred to some great Municipal Authority? In such a case there may not be any salary to a Chairman or a Vice-Chairman, but there will be a large staff of officials, and the appointment of these will give the Municipal Authority the opportunity for an agreeable exercise of power. When we hear so much said about the interests of the ratepayers, it may be well to remember that the dignity and influence of the Local Authorities will be enhanced by the possession of the Water Supply of the

Metropolis. Whatever may be the precise value set on the property of the Water Companies, it is evidently worth many millions sterling, and we need not marvel if there is a resolute attempt to wrest such a prize out of the hands that hold it. The old revolutionary theory that private property is public robbery seems now to present itself in another form. Private property is claimed "in the name of the public," and the claimants are to fix the price.

At the Metropolitan Board on Friday last there were some amusing references to the "outside parties" who were having the audacity to meddle with this Water Question. People calling themselves representatives of Vestries and District Boards were holding meetings, conferring with Members of Parliament, and proposing to seek interviews with Cabinet Ministers. Such effrontery was felt to be insufferable. "I "must protest," said Mr. Fowler, "against any body of gen- "tlemen meeting together and calling themselves the repre- "sentatives of the ratepayers." Mr. Fowler is perfectly right. As we suggested a fortnight ago, these outside gatherings are unconstitutional and schismatic. "We are the "proper and only body to deal with this question," said Mr. Richardson. "The principle is this," continued that gentleman, "that the central representative body of the Metropolis "should have charge of the water supply." Unfortunately people seem apt to forget their best friends. Even one of the members of the Board was disposed to doubt whether the "central representative body" of the Metropolis had any claim at all on the gratitude of his constituents. He complained that, although the Board had the power to compel the Water Companies to furnish a constant supply, they had failed to exercise that power. A memorial had been sent up from Shoreditch, the parish which he represented, asking the Board to compel the New River Company to provide a constant supply; and, after keeping the memorialists waiting for five months, the Board decided not to comply with the request. Mr. Tolhurst, who moved that the subject should be deferred for six months, remarked on the fact that nobody asked the Board to interfere with this matter. The delegates took no notice of them, and a public body which had just passed a resolution on the subject were going to seek an interview with the Prime Minister. But whatever meetings were held, or whatever agitation was got up, nobody asked the Metropolitan Board to do anything. Some little time back, said Mr. Tolhurst, the Board had gone to a great expense and taken a vast amount of trouble to deal with the Water Question, and, after all, they were "never so much "as thanked for it."

On the whole, there seems to be a feeling rising at the Metropolitan Board that the Water Question is passing out of their hands in a way that is perilous alike to the *prestige* and existence of that body. The Board have done much to bring on the present crisis, and having sown the wind they have reaped the whirlwind. Their policy was to let the water supply drift to the bad, in the hope that then the entire charge of it would be taken from the Companies and handed over to them. This policy has entirely failed to benefit the Board, but it has precipitated the question, and that in a very awkward form. On all hands it is now said that something must be done. It is a new and startling thing to find members of the Metropolitan Board acknowledging that, as at present constituted, the Board are not competent to take charge of the water supply. The task would be too onerous, and the labour too great. Mr. Selway has faith in the Board, but he so far feels the pressure of public opinion as to say, "If the Board is not large enough or wise enough for "the purpose, let it be made a larger and more clever Board." Other members speak more boldly still, and every member apparently feels that if the Board be not in a position to be entrusted with the water supply, it ought to be placed in that position. There is, doubtless, truth in this view of the case. The Board, as "the central representative body," ought to possess the confidence of the public and of the Government, and ought to be naturally and inevitably looked to as the centre of authority for dealing with such a question as the supply of water to London. It will be a remarkable fact if the Water Question, after being in some degree connected with a change in the *personnel* of the Imperial Government, should be the immediate cause of a radical reform in the local government of the Metropolis. Already the pressure of this question has practically converted some members of the Metropolitan Board to the persuasion that a change in the constitution of that body is necessary. To remain unaltered is standing rigid amid the storm, when safety is to be obtained by submission. If anything can hasten the advent of a new government for London, it is this very critical question of the water supply. The Vestry delegates virtually demand that the Water Companies shall continue to exist until London is reformed. Happy delegates, who are willing to be swept away, so that they may but know that the Water Companies will follow next!

EFFLUVIUM NUISANCES.*

The greater part of this Blue-book, to which general reference was made in the last number of the JOURNAL, consists, as was then stated, of a highly interesting report by Dr. Ballard on effluvium nuisances, such report forming the third and concluding portion of his account of the inquiry into this matter upon which he has been engaged, not without intermissions, since November, 1875. "In former portions"—we quote from the general introductory remarks of the Medical Officer—"industrial processes that are concerned with animals, animal substances, and with vegetable substances, have been considered; and in the present portion an account is given of various offensive processes, wherein mineral substances are principally concerned, and of others wherein materials of mixed origin—animal, vegetable, and mineral—are dealt with. The governing idea of the inquiry has been to study 'effluvium nuisances' in their relation to the health of the community; and thus their influence within workplaces upon persons voluntarily subjecting themselves to such nuisance has been studied chiefly as it might throw light on the nature or circumstances of the influence which the nuisance could exert upon the outside community. In the course of Dr. Ballard's inquiry, some 70 different kinds of businesses, represented by 850 separate trade establishments in various parts of the United Kingdom, have been investigated; and it is probable that few offensive trades of any importance have been omitted. In the account of them considerable technical accuracy has been secured, through the willing and active co-operation of manufacturers."

The object of Dr. Ballard's inquiry has been twofold—first, "to learn the extent to which the public health is injured by one or another offensive trade or trade process, under one or another condition; and, secondly, to ascertain in what measure, and under what circumstances, nuisance and injury to health can be avoided."

In the study of the former problem, it has been impracticable to specify by a numerical method the absolute amount of sickness or mortality actually due to proximity to offensive trade establishments, there being no reliable data by which the effects of such establishments can be distinguished from those arising from other causes, and Dr. Ballard has consequently been compelled to rely upon his experience as a physician and sanitary observer, and upon the testimony of other duly qualified professional men, as to the interpretation which may rationally be put upon the health-rate of a particular district. Dr. Ballard's conclusions upon this subject, resting as they do on a broad basis of careful observation by one whose opportunities have been altogether exceptional, are of great value, as adding materially to our previous knowledge, and forming a good point of departure for further investigation.

The general result may be thus expressed: There are, first, a variety of influences upon health, due to certain trade processes, which are not only offensive, but are concerned with definably infectious or poisonous materials in quantity, and are consequently infectious or poisonous to workers or neighbours. As an illustration of trade processes dangerous from their dealing with infectious matter, we may instance the treatment of house refuse; while processes which give off poisonous gases or vapours, such as the arsenical vapours from galvanizing works, or the emanations from limekilns, fall into the second category. Leaving these two sorts of offensive businesses, in which the nuisance is accompanied by a major evil influence, the bulk of Dr. Ballard's report deals with trades and trade processes in which mere offence is the predominant feature. In these he recognizes several kinds of influence upon health:—(1) The effect of stink, merely as stink—an influence of common character attaching to offensive businesses generally, independently of the nature or cause of the stink itself. This influence consists of a group of symptoms of singular constancy, representing a disturbance of digestive and circulatory functions, along with, and probably due to a number of sensory disturbances, such as loss of appetite, nausea, sometimes actual vomiting, sometimes diarrhœa, headache, giddiness, faintness, and a general sense of depression or *malaise*. Some individuals suffer from this influence more than others, and some persons become more and others less sensitive to it with custom and time. Sickly persons are particularly liable to suffer from it, sometimes to a serious degree. (2) Then certain trade effluvia are distinguished by their exerting an acrid, irritating effect upon the surfaces of the body, particularly on the eyes, air-passages, and sometimes even on the skin. (3) Having arrived at this point, Dr. Ballard is precluded from assigning definite disease and death to the operation of the emanations from offensive trades or trade processes, by the non-existence of statistics, or rather by his inability to measure the influence of one and another disease-producing condition, the sum only of the entire effects of which is given by the statistics of mortality. He is able to trace the effect of a variety of trade processes upon comfort and ease of life, but as to the more serious effects possibly produced upon health and life by similar causes, he finds himself unable to speak definitely, for want of unmistakeable relation between observed disease and the offensive trade as its cause. Given, for example, continued respiration, in the vicinity of offensive works, of an atmosphere moderately charged with sulphuretted hydrogen, and an observed depression of general health with some nervous disturbances in persons exposed; other

* Eighth Annual Report of the Local Government Board, 1878-79. Supplement containing the Report of the Medical Officer for 1878.

circumstances, such as conditions of lodgment and diet, would have to be taken into account before the offensive gas and the failing health could be connected as cause and effect. Yet suggestions of the reality of such connection were, in this instance, not lacking, even with limited investigation. Again, the prevalence of acid vapours in certain neighbourhoods could not be distinctly affirmed to produce actual disease of the respiratory organs, although the organs appeared to suffer, and people with delicate chests were commonly observed to complain of aggravation of their sufferings. Of the popular belief that acid gases have conversely some power for good in preventing the spread of infectious disease within the range of their influence, Dr. Ballard finds no confirmatory evidence whatever. On the whole, the report tends to show that "the presence of an offensive business, though it may not rank in the infective or poisonous class, yet deserves to be rated along with, and prominent among those conditions that cause one place to be less wholesome than another place;" although, at present, it may not be possible to affirm the extent or nature of the share that the business has in the production of the total result.

"As regards the second object which the Board has sought to obtain from this inquiry—viz., to learn in what measure and by what means nuisance and injury to health from offensive businesses may be avoided—the report leads to a quite satisfactory result. It shows that by the application of such knowledge as is now at command, all or nearly all businesses that are now in a serious degree offensive may be carried on either without offence, or with such important reduction of offence as shall make it tolerable or even trivial. The means of avoiding or lessening offence are fully discussed by Dr. Ballard for the several businesses to which his inquiry has extended, and it is not the least satisfactory feature of his inquiry that it is commonly found in practice to be as much to the interest of the manufacturers as of the public that the emanations from offensive processes should be thus arrested."

Thus far we have closely followed, with some condensation, the comments of Dr. George Buchanan, the Assistant Medical Officer to the Board, who (in the absence through illness of Dr. Seaton, the Medical Officer) has summarized the results of Dr. Ballard's inquiry in his own general report; and the insight thus afforded into the nature and scope of the aforesaid inquiry, while presenting sundry considerations which should be borne in mind during the perusal of the detailed report, must at the same time arouse considerable interest in the subject of it, particularly to those whose occupation may happen to attain the somewhat doubtful honour of Dr. Ballard's attention.

It is impossible to praise too highly the care with which the inquiry has been carried out; every one of the great number of different manufactures included in its scope having been subjected to a searching examination, which has resulted in the compilation of exhaustive descriptions, elucidated wherever necessary by drawings and photographs of the minutest details of every process involved which might be considered either a cause of offence or as explaining its existence. Parenthetically we must accord a certain admiration to Dr. Ballard for the heroism with which, at the call of duty, he encountered in his own person nearly a thousand different odours, rivalling each other in vileness—not merely braving them, but wilfully stirring them up and tracing them to their sometimes obscure origin. Fortunately he does not appear to have suffered materially in health from his five years exposure to influences which he credits with considerable powers for evil, and this circumstance, if true—and there is no evidence to the contrary in the report—gives hopes for others who, if longer subjected to one or another effluvium, may be reasonably expected, under ordinary conditions, to escape such a complication of stinks as Dr. Ballard incurred during what he can scarcely remember as the pleasantest pilgrimage of his life.

Concerning the utility of Dr. Ballard's inquiry, no doubts can prevail. He has placed on record the willingness with which manufacturers and their responsible agents met his inquiries, and explained to him their methods of working, very generally supplying him with drawings and photographs, and even, in many cases, correcting the proof-sheets of his notes, in order that his descriptions and observations might be technically accurate. The result may be seen in the clearness which marks his treatment of every process he has touched, and which in many respects raises his report to the level of a dictionary of offensive trades. A catalogue of such trades having been determined upon, it was obviously of the first importance it should be as complete and accurate as possible, in order that a vast amount of popular ignorance and the prejudice of many persons who should be better informed might be set right. The existence of such perfectly unbiassed testimony as that contained in Dr. Ballard's descriptions of certain trade processes which ere now have proved bones of contention between manufacturers and the public, should be welcomed on both sides. Manufacturers prove thereby that there is no mystery in operations which they have, sometimes with good reason, refused to show to outsiders who have been actuated by hostile curiosity; and, on the other hand, the custodians of the public health are instructed in the *rationale* of proceedings which they might otherwise regard with especial jealousy. It is instructive to note that increased knowledge has, in Dr. Ballard's case, resulted, in the usual way, in the diminution of confidence in dogmatizing on the effects of most of the trade effluvia mentioned by him. His caution in alleging positive injury to health in any case is in marked contrast to the assurance which is so characteristic of ill-informed or amateur nuisance inspectors, who are generally so eager to swear that all the ills that flesh is heir to are clearly due to the malignant vapours from some particular establishment they are determined to annihilate.

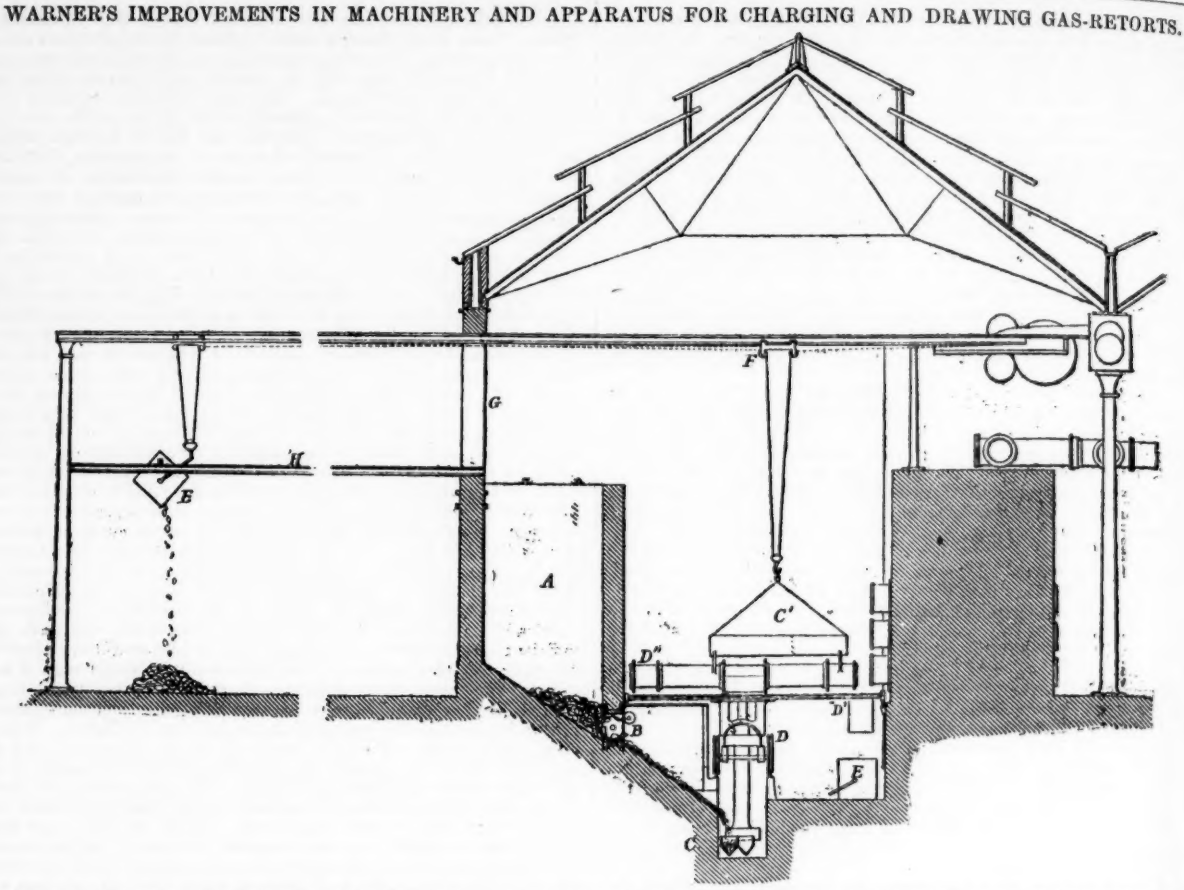
Unfortunately for the preservation of unbroken harmony between manufacturers and the public, the sense of smell is particularly out of joint with the operations of a large number of highly necessary trades. For a single pleasant odour produced in the arts there are a thousand processes with either no smell at all or a decidedly unpleasant one, frequently deserving the homely Anglo-Saxon epithet so sensibly used by Dr. Buchanan. Whenever this latter occurs to any great extent, the idea which generally arises in the public mind is that wholesale poisoning is in progress, and this is an error which Dr. Ballard is able to correct. It seems to us, however, that the possible action of certain acid fumes in aërial disinfection is undervalued by Dr. Ballard. Take, for instance, as an extreme case, the fumes of burning sulphur, or sulphurous acid vapour. This is in use as a powerful disinfectant in cases of infectious disease, and while its presence in the atmosphere of any locality would, of course, be a great nuisance, yet if its disinfecting power were exercised, according to the proportion in which it existed, on any infectious matter which might otherwise exist in the air, it seems evident that to this extent it would act beneficially, although, after all, the result of its diverse actions might be undesirable. No one at this time of day will be likely to contend that a manufacturer, for his own immediately selfish ends, has a right to render the lives of his neighbours burdensome to them, or very possibly to cut them short altogether, by diffusing horrid smells over an indefinite extent of adjoining territory, any more than he may obstruct thoroughfares or poison wells. And it is not in accordance with human nature that the initiative in restraining himself from such acts should in all cases rest with him, especially if the restriction causes him expense or inconvenience. There must be opposing forces to cause every departure from established lines. But the directing or regulating power must not be too exacting, so as to render the manufacture impossible, either by sentence of banishment, or by imposing too stringent regulations, under which it could not be carried on profitably. Carelessly-managed or old-fashioned establishments will have no sufficient excuse for their unregenerated existence if Dr. Ballard's descriptions of better-managed works should be taken note of by sufferers from unnecessary nuisance. It can be no real hardship to compel lagging manufacturers to keep pace with their more enterprising brethren in the matter of the suppression of effluvia. When all are under equal restrictions, there can be no grumbling, and if any extra outlay is involved in the prevention of nuisance, it is obviously unfair, especially in the case of manufacturers who have to compete with each other in the open market, that some should be saddled with an expense from which others are free. In this respect the accessibility of such valuable information as the report contains will be of great benefit to sanitary authorities and manufacturers, by informing them of what is being done in localities of which their knowledge might otherwise be small.

For ourselves, we are of opinion that the damage done to public health and the comfort of the community by unavoidable effluvia from trade processes is small, confined as it is, in most cases, to special districts. A noisome factory is not often established in an otherwise favoured locality. The very nature of most trades of the kind, the necessities of their supply with raw material, or the possession of facilities for the disposal of their products, and the proximity of the labouring population from which their workpeople are drawn, generally presuppose a locality in which a fresh stink of any moderate dimensions is but an addition to an already settled family. We are not denying the abstract right of the poorer classes, as fully as those above them in the social scale, to pure air and sunlight, when we express our conviction that, as a rule, in town or country, they are steeped in odours compared with which most trade effluvia are bearable. Their condition has, it is true, vastly improved of late years; but much still remains which, when finally rectified, will remove a very present difficulty. This lies in the practical impossibility of accounting for the origin of every disagreeable smell noticeable in a crowded manufacturing district, or of ascribing a low state of general health to its right cause. We have before our mind the case of a suburban district of a large northern town which is thickly covered with chemical works and every kind of vile-smelling trade which Dr. Ballard has catalogued. The sky is darkened with smoke, stenches in infinite variety assail the wayfarer as he passes along clinker-made roads fringed with steaming sheds or sooty workmen's cottages, and everything would tend to give a stranger the idea that epidemic disease would there find a suitable home. On the contrary, the drainage being good and the water supply excellent, all the superficial dirt and trade effluvia do not prevent the district from being exceptionally healthy, rejoicing in a death-rate actually lower than that of many more pleasant residential localities not far distant.

We shall find, as we proceed, that Dr. Ballard has devoted much attention to gas-works, which, of course, he classes among other offensive trades, although he does not credit them with any specially diabolical influence. As we shall, in a subsequent article, examine in detail his statements respecting them, we shall here only remark that the smoke and steam which emanate from gas-works form one count of the indictment in this case as in several others. Speaking here merely of the influence of such a species of air-pollution on public health, it seems straining a point to regard as a grave nuisance a quantity of coal smoke, which, under the worst conditions, cannot be more than the most insignificant fraction of the total amount of unconsumed carbon sent into the air from the myriad chimneys of a populous town, and which, when mixed up with other vapours in the form of a thick yellow fog, becomes probably the most noxious mixture which human beings can be compelled to breathe.

Having now considered a few of the general questions presented by the great problem embodied in this voluminous report, we will in our next notice proceed with the examination of Dr. Ballard's observations on gas-works, and the nuisances said to arise therefrom.

WARNER'S IMPROVEMENTS IN MACHINERY AND APPARATUS FOR CHARGING AND DRAWING GAS-RETORTS.



A short time since, in publishing in the JOURNAL an account of two visits paid to the Jarrow works of the South Shields Gas Company—the first by the Shareholders of the Company, and the second by a large party of Gas Engineers and others, the object on both occasions being to view Mr. Warner's recent improvements in machinery and apparatus for drawing and charging retorts, and for doing the work immediately in connection therewith—we gave a general description of the arrangements, and promised further details and drawings. With this week's number is issued a double page plate, showing the drawing and charging apparatus proper, while the above engraving is a cross section of a retort-house, with the arrangements for carrying out Mr. Warner's inventions in their entirety.

The improvements are based upon inventions for which letters patent were granted in 1875, and provisional protection in 1877, to Mr. W. J. Warner. The invention we now notice is designed to improve and simplify the machinery for charging and drawing retorts; and, at the same time, by mechanical means, to prepare the charge of coal for the scoop, and discharge the coke from the retort-house. The work is thus dealt with under what must be considered as three separate divisions—viz., coal-getting, or preparation of the charges for the machine; drawing and charging; and delivery of the coke from the house. We shall describe the arrangements for dealing with the work mechanically, as they are in operation at the Jarrow works of the South Shields Gas Company.

The retort-house is constructed in the usual way, with the exception of the floor, which is about 6 feet below a platform at the ordinary floor level, and has a channel about 3 feet square running parallel to the platform the whole length of the house. The width of the platform is 5 feet, and the space between it and the beds of retorts is about 10 feet. On the edges of the channel, rails are laid for the machine to run upon; and under the platform is an endless rope, by which the machine is driven. A shaft also extends the whole length of the house, which drives revolving "diggers," for drawing out the coal from the openings in the lower portion of the "coal stores," or "bunkers," built opposite the beds. Sheet-iron "buckets," or troughs, divided into two compartments, each to take a charge of coal, receive it from the diggers, down an incline to the channel in the floor. Over the centre of each bed, and carried through an opening in the side of the house to about 30 feet beyond, a pair of light H-girders are fixed, which are a part of a simple hoist. The hoist is driven by a shaft along the house above the beds, and is for raising the coal and holding it in its position for delivery to the machine, also for lifting the coke in the iron buckets into which it is drawn, carrying it from the house, and depositing it on its heap, which it does without any labour in trimming being spent upon it.

The machine for drawing and charging is carried by a quadrilateral frame, 10 feet by 3 feet, mounted on wheels. Its general features are two vertical cylinders with hollow rams, on each of which is mounted a cradle, or frame, for carrying the scoop or rake. The tools so mounted are free to turn on the rams, and, therefore, may be worked at any angle, each tool being entirely independent of the other. The retorts are placed at equal distances along the house, and the distance from centre to centre of the rams or tools being the same, the two tools are brought in succession to each retort as the machine travels along, but with only one adjustment to each, the retorts being taken in tiers.

The above illustration shows the general arrangement of the machinery. A is the coal store or bunker from which the coal is drawn, being broken, if necessary, by revolving diggers, B, and fed into a trough-like box, or "coal-bucket," C, divided into two compartments, each having the capacity of a charge of coal, the bottoms being hinged and supported by chains. When filled, C is raised into the position C', ready to deliver the charges into the scoop when required. The whole of the charges are thus prepared at leisure, and suspended as shown. The machine, D, D', D'', is mounted on a carriage, D, and runs upon rails extending the whole length of the house. D' is a platform from which the machine is actuated. D'' represents the two tools, rake and scoop, for doing the work, as the machine, which is driven by the endless rope, travels along the house. The coke of each tier of a bed, two charges to the bucketful, is drawn into a coke-bucket, E.

After the work of drawing and charging is finished, the third portion of the work—the delivery of the coke—is proceeded with. The empty coal-buckets are lowered to C, the coke lifted, and carried from the house by hoists, F, through openings, G, in the side of the house. The coke is then delivered by the bucket being lowered upon the coke platform, H, where it is inverted, by an axle fixed to its under-side coming in contact with two light girders, discharging the coke. A 10-horse power engine drives the rope for the machine and the two shafts for working the diggers and hoists. The whole work is done from the interior of the house, and is entirely under control.

The details of the machine are shown on the separate plate of engravings; fig. 1 being the back end view, and fig. 2 the side view. It may be simply described as consisting of two tools, rake and scoop, mounted on a carriage, with the mechanical arrangements necessary for effecting the several operations of transmitting the power from the running cord to the machine, and for adjustment and work. The cord, A, as shown, runs under two pulleys, B', B'', and over one, B, between them. Power for traversing is given through B'', and transmitted by a disc and friction-wheel to a worm and worm-wheel, thence to spur gear as shown, fig. 2, under the platform. By means of its pinion and bevel gear, pulley B drives the main shaft of the machine, C, fig. 1. On each side of this main shaft, bolted to the carriage, there is a vertical cylinder, D, D, fitted with a hollow ram, E, E, in which a screw is secured by a nut below, the screw being in length somewhat in excess of the difference in height between the highest and the lowest retorts. By means of the bevel and spur gear at the lower portion of, and driven by the shaft, C, the necessary changes of motion for raising and lowering the tools to adjust them to the varying requirements of the retorts are effected; each tool having the power of independent adjustment. The power for driving the machinery for each tool is obtained by the spur-wheel from the upper part of the main shaft, C, driving the secondary

shafts, F, F, which, with the wheels, G, G, geared to each tool, are raised and lowered with the lift by the brackets, H, H, keyed on the cylindrical rams. These shafts are grooved, and work through feathered bushes, or fillbores, which revolve in their seats with the shafts. It will thus be seen that each tool has not only an independent vertical action for adjustment to the retorts, but also that the power for driving the tools is continued through the adjustment by means of the rising and falling shafts. In other words, there is the power of adjustment while the tools are at work. The spur-wheels, G, G, keyed on the shafts, drive the wheels, I, I, which are loose on the rams, and drive I′, fig. 2, which drive bevel-wheels and clutches, of which J, J are the handles. The changes of motion necessary for driving, reversing, and stopping the tools are communicated to the main driving-wheels, K, K′, through the intervention of the chains, as shown.

Up to this point the action of the two tools is identical. In the case of the scoop, the axial motion for turning it to deliver the charge of coal into the retort is connected with the travelling motion of the scoop; but the rake tool has an independent axial motion, which is under the control of the workman. The latter motion is obtained from the handle, J, which, besides working the clutch by a to-and-fro motion, can also be moved through a portion of a circle to give the axial motion to L, which is effected by a quadrant keyed to the handle, and a pinion, shaft, and wheel, L′, which is connected with the axial shafts by a short chain, as shown in the end view. The axial shaft is square, and supported at the ends of the rake frame, M, M′, at M, in a bearing in the ordinary way, while at M′ the shaft is keyed to a disc working among four guide-rollers. The rake shaft which passes through the disc is attached at the rear end by an arm, N, to the axial shaft, along which it is free to travel with the crosshead of the rake, as it is drawn along the frame by the chain, which passes over pulleys at each end. In action, the rake passes over the coke, enters it upon receiving the axial motion, and upon the stroke of the rake being reversed the coke is drawn from the retorts. Each motion is independent of the other, and entirely under the control of the workman, and hence adaptable to any condition of charge. The axial motion of the scoop is given by bevel-wheels, shown in the end view, at the scoop head. One is keyed to the shaft of the scoop, and the other is keyed on one end of a cross shaft, passing through the slide, O. To the other end of this shaft is keyed a crank-arm, the pin of which passes through a link of the endless chain, P, P, for driving the scoop.

The action of the apparatus is as follows:—The arms, Q, Q, catch and guide the coal-bucket as the machine travels into its place. The charge is delivered into the scoop through the hopper, R. By the handle, J, the scoop is started; the endless scoop chain, P, P, carrying with it, by means of the crank-pin, the slide and scoop, which are supported by the slide-bars and cradle. The charge being thus driven into the retort, is deposited by the crank being carried round the fore wheel, O′, half a revolution with the chain, which gives the necessary half turn to the scoop by means of the bevel-wheels. The motion being continued, the scoop is withdrawn, and returned to its place and former position by the crank-pin being carried round the rear wheel, O. The handles, T, T, are for traversing, and those beneath them for actuating the rams.

The two tools have not only the power of vertical adjustment, but they may also be moved round on the axis of the rams, and the distance between the two centres may be altered by means of a slide arrangement, attached to the head of the ram, actuated by a screw and hand-wheel as shown at U, fig. 2, immediately under the rake frame. The object aimed at by these arrangements is entire control over the adjustment of the tools, that they may be adapted to any alterations in working or setting, thus preventing any prejudicial action upon the retorts. So adaptable is the machine to varying circumstances, that the tools will work retorts with their axes either divergent or convergent. Indeed, the power of adaptability is such that two stacks may be worked face to face by this machine; a tier being taken on one side, then each tool and its cradle raised in succession to clear the other, swung round, and a tier upon the opposite side taken. With such an arrangement the coal stores may be placed parallel to the beds, behind the retorts on either or both sides of the house, and in the same or separate buildings. The coke would then be stacked beyond the coal stores, or on the opposite side of the house if only one coal store were constructed. The plan of the machinery in connection with the lift and coal feeders would be arranged to suit the altered general plan.

Though it is somewhat recapitulating, the mode of working the whole of the machinery is as follows:—The shaft or rope for driving the feeders being set in motion, a bucket is filled with two charges of coal, lifted by the hoist, and put into position in front of each bed to be charged. Assuming that the retorts have been charged, and the charges worked off, the machine has its tools adjusted by the screw lifts to the tier of retorts to be taken, and is then run into position for drawing. The drawing is done by the attendant on the drawing platform, by passing the rake into the retort over the top of the charge, giving it an axial motion, and reversing at the same time, thus pressing the rake-blade into the coke, and withdrawing any portion of the charge desired, and repeating the operation as often as is necessary for clearing the retort. The charge being drawn, the machine is moved on, and the scoop brought into position for charging. This again carries the rake into position for the next retort, as the retorts are at equal distances along the house, and the centres of the two tools are at the same distance; but if the retorts are not so set, or get out of the true in working, the slide may be used for adjustment.

In adjusting the machine for charging, the arms on the cradle and hopper are used to carry the coal-bucket into position for delivering the charges. The attendant of the charging tool then delivers a charge into the scoop direct from the bucket, the scoop is driven into the retort, and, arriving at the full extent of its travel, receives its axial motion, then returns into its cradle, completes its one revolution, and is ready to receive the next charge, which is delivered, the bucket raised, and the machine moved to the next retort, and so on till the whole of a tier of retorts is charged.

It will be observed that, by such an arrangement of working, the time occupied by the operations of drawing and charging is reduced to a minimum, as the work in connection with these operations during their progress is reduced to the lowest possible amount. The charge of each bed is ready to be delivered into the scoop, and the coke is delivered into buckets, to be removed after the work of drawing and charging is over, or drawn into waggons under the retort-house floor, in the usual way; or the work may be done in both ways. It is evident, however, with this system of delivering the coke by overhead gear, that the labour of stacking is avoided, and that less breeze will be made. There will also be less chance of a breakdown by such a division of the work. The coal charges being made ready before the drawing and charging commences, these operations are next effected, and the coke subsequently removed.

Though the machine is shown below the floor line of the retort-house, it is obvious that the same general arrangement of machinery may be placed in suitable framing, and made to travel on or above the floor of the house.

Communicated Article.

DR. ADAMS'S GAS-STOVES.

We have received the following communication from Dr. Adams:—

The editor of a contemporary journal, in commenting on my stoves, invites me to give information on a point where doubt exists. He says, "There is one point in their construction with regard to which we desiderate information, and that is: Suppose in a room a stove of a given size is requisite to raise the temperature, say, to 60°, and that in the course of the day, changes in the weather render the full heating power of the stove unnecessary. Is there any provision for keeping it going with half the quantity of gas, so as to get a reduced number of heat units? or must the stove, as we suppose it must, continue to consume its full measure of gas, in order that the exact mixture may be obtained to secure complete combustion? If such provision has not been made, we think that some mechanical appliance might be contrived which would regulate the flow of gas and air in the desired proportions, whether the stove is working up to its full power or not."

The query and suggestion are alike shrewd and of practical importance, and it is well to have the point made clear. The conditions referred to were carefully considered by me many years back, and I devised and practically carried into effect, in an embryo stove, a solution of the problem precisely within the lines indicated. In the words of my patent, "the object is effected by providing the general air-inlet opening with valves or discs, self-regulating under the pressure of the inflowing air, or capable of being adapted to a desirable fixed area."

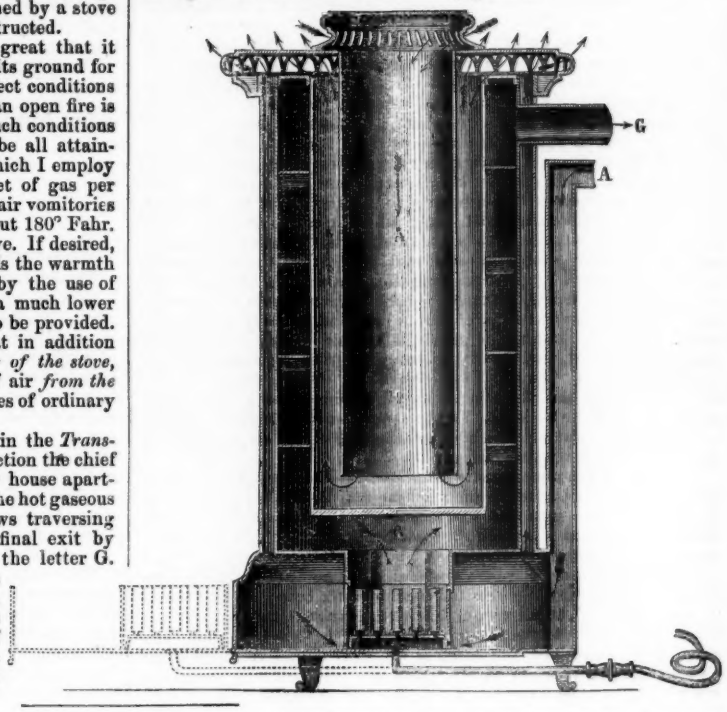
But although provision has been made for the contingency suggested, there is in the stove, as now constructed, no practical need for a special contrivance which necessarily complicates and increases the cost of the apparatus. The object is sufficiently and almost as perfectly attained by the peculiar construction of the air-inlets and of the flues. The velocity of the air entering the furnace chamber to support combustion undergoes acceleration or retardation in a ratio with the heat of the chamber, and this again is influenced by an increase or diminution in the supply of gas. The openings which admit the due proportion of air to the furnace chamber are regulated in accordance with the estimated supply of gas, and the supply of gas is under the regulation of an efficient gas-governor. On leaving the furnace chamber, the hot waste products of combustion pass through a series of contracted uptake openings communicating with the superimposed horizontal chambers of which the flue is constructed. The hot gaseous products thus pass, not in a continuous, smooth current, as in ordinary stoves, but in abrupt gradations from one chamber to another; and the volume of the hot vapours thus undergoes a series of alternate expansions and contractions, which influence still further the mean velocity of the current. The result is that the stove when in use is always in efficient action, and when the full heating power is not desired, the heat may be diminished precisely as the light of a gas-jet is increased or diminished at pleasure. The case suggested by the editor is illustrated daily in the use of the stove which warms my own study. Thus, on the morning of the day on which I write, the temperature of the room was 45° Fahr. Within two hours after lighting the stove the temperature of the room had risen to 62° Fahr. The gas consumption during this period was 15 cubic feet per hour, that being the intended full power of this particular stove. I then turned down the gas to the extent that I guessed would be sufficient, and the temperature of the room throughout the day, and until the late hour at which I am writing, has remained at 59° to 60° Fahr. I find that the gas consumption is at present 10 feet per hour. The convenience has, therefore, been all that I desire, and practically meets all that has been suggested as desirable.

In this connection it is worthy of mention that neither with the ordinary grate nor with an American stove grate could I previously get the room comfortably heated, owing to its exceptionally faulty construction. It so overhangs an open court-yard that the floor is exposed to the cold outer air; it has two thin outside walls, and

there are 72 square feet of window glass. A room more difficult to warm could, therefore, scarcely be contrived. It is 16 feet by 13 feet and 12 feet in height, with a cubical capacity, in round figures, of 2500 cubic feet. A ventilator (with which every stove-heated room should be provided) keeps the air-supply fresh. The chimney is so dominated by neighbouring buildings, and is otherwise so faulty, that before the fire of a coal grate or coal stove could be got fairly alight there was encountered, frequently for an hour or more, a dense atmosphere of pungent smoke, and a persevering course of trimming attendance was necessary. It happened, indeed, very frequently that rather than suffer the discomfort to myself, and damage of books and instruments, caused by the smoke, the dirt, and dust of coal and ashes, &c., I preferred to shiver in a great-coat and railway rug while occupying the room. Now, in the worst conditions of wind and weather there is only occupied a second—or, on rare exceptions, when first lighted during gusty weather, one or two minutes—to set the stove in full action, and thereafter the room becomes warmed at an average rate of 10° per hour. A room of similar size, but free from the exceptional difficulties referred to, would be efficiently warmed by a stove of half the size and power, such as I recently had constructed.

The open fire has special advantages, which are so great that it will ever remain a favourite in this country, and hold its ground for domestic use against the inducements of the most perfect conditions that the most perfect stove can ensure. But at times an open fire is impracticable, or inconvenient, or non-efficient, and in such conditions comfort, convenience, and economy may, nevertheless, be all attainable through the use of a good gas-stove. That which I employ burns on an average—when in full use—15 cubic feet of gas per hour, and with that supply it discharges from the pure air vomitories more than 4000 cubic feet of air per hour, warmed about 180° Fahr. above the temperature at which the air entered the stove. If desired, a much higher temperature may be obtained, but that is the warmth aimed at in the most approved methods of heating by the use of steam-pipes. Hot-water pipes supply warmed air of a much lower temperature, and, if desired, that temperature may also be provided. Under all circumstances, it must be borne in mind that in addition to this large discharge of heated air *from the interior of the stove*, there is also given out heat by radiation and contact of air *from the exterior surface*, precisely in the manner of the best stoves of ordinary construction.

The accompanying drawing, taken from my paper in the *Transactions of the Glasgow Philosophical Society*, shows in section the chief peculiarities of one modification of a hot-air stove, for house apartments, school-rooms, warehouses, conservatories, &c. The hot gaseous current formed by the ignited gas is shown by arrows traversing the series of chambers and contracted openings to its final exit by the flue leading into the chimney, and indicated by the letter G. The course of the pure air which enters the stove in order to be warmed is indicated by feathered arrows. One supply enters by a pipe at the back of the stove, indicated by the letter A, and the stream of air is seen to enter the air chamber at the base of the stove, and to give off a small and regulated supply to the furnace chamber for combustion of the gas. The main stream is seen to pass upwards between the outer duplicate casings of the stove, and to be discharged at the top. Another supply enters at the summit of the stove, and, following the course of the descending arrows, becomes reversed at the bottom of the hanging central tube, and ascends, passing out at the top. The dotted lines at the base of the drawing represent the arrangement for preventing explosions. The entire furnace chamber is drawn out on a sliding tray or drawer, and until that is done the gas is inaccessible. When the furnace chamber has been drawn out to light the stove there enters at the same instant a large body of air, which thoroughly ventilates and frees the stove from any explosive accumulation that under any circumstances may have formed (but which under any circumstances could scarcely ever form in this stove, because it is continually traversed with a current of air, whether in action or out of action). The gas, therefore, can only be *ignited openly in the unconfined air of the apartment*, when it is no more liable to explosion than that of an ordinary gaselier.



Correspondence.

[*We do not hold ourselves responsible for the opinions expressed by Correspondents.*]

PUMPING GAS AT BECKTON.

Sir,—The publication in your Journal of April 20 of an account of our pumping arrangements here has drawn forth a letter from Mr. King, and one from Messrs. Gwynne and Co., in which they lead your readers to infer that the idea and arrangement of our pumping machinery has been copied from that fixed at Liverpool.

I beg to say, as far as I am concerned, that I have not seen the machinery they refer to, and their letters were the first intimation I had that anything of a similar character existed at any other works. If it should turn out that the two arrangements are identical, it only goes to prove the old saying that "there is nothing new under the sun."

G. C. Trewby.

The Gaslight and Coke Company,
Beckton, North Woolwich, April 30, 1880.

The Bray Lantern and Burner, and Mr. Sugg.—We have received a letter from Mr. Bray, in reference to Mr. Sugg's communication published last week; but it is accompanied by a sketch which there is not time to have engraved for insertion in to-day's issue.

Legal Intelligence.

HIGH COURT OF JUSTICE—EXCHEQUER DIVISION.

Thursday, April 22.

(*Before the* Lord Chief Baron *and a Special Jury.*)

HUMBER *v.* THE TOPSHAM, WOODBURY, AND LYMPSTONE WATER-WORKS COMPANY.

This action was brought to recover the balance of a sum of money, claimed by the plaintiff for work done by him, as a Civil Engineer, for the defendants. The defendants denied their liability, alleging that plaintiff never was employed by them to do the work claimed for; and they maintained that, in the event of their being found liable, the sum of £175, already paid by them, was sufficient for the work actually done.

Mr. Bompas, Q.C., and Mr. Nasmyth appeared for the plaintiff; Mr. Charles, Q.C., and Mr. Edwin Jones for the defendants.

Mr. Bompas, in opening the case, said the plaintiff, Mr. W. Humber, was a well-known Civil Engineer who had devoted himself especially to the subject of water-works, and he (Mr. Bompas) believed the plaintiff was acknowledged to be one of the chief authorities upon this branch of civil engineering in the country. The action was brought by the plaintiff to recover the ordinary payment of a civil engineer as Engineer for some water-works which were started by the defendant Company. The Company was formed in 1868, and in that year they obtained an Act of Incorporation. They failed for some time to carry out their undertaking; but in 1871 they commenced making their works in the neighbourhood of Exeter, and these works were carried out to a considerable extent entirely under the superintendence of the plaintiff, whom they appointed their Engineer for that purpose. The contractors unfortunately failed to fulfil their contract, and when the works were partly completed they were stopped. Efforts were made to obtain other contractors to complete them, but owing to the depression of trade the matter was postponed for a time, though in due course the works would no doubt be completed. The defendant from time to time asked for payment on account, although he did not feel himself entitled to be paid such a sum as an engineer would be entitled to when the works were finished. The defendants making no apparent effort to complete the undertaking, plaintiff sent in his claim for commission, and there was a letter sent to him by the defendants, denying all liability. The present action was therefore brought to decide whether the plaintiff was entitled to be paid for his work or not. The grounds of defence set up by the defendants were that the plaintiff never did the work; but this was merely formal. There was no doubt that Mr. Humber prepared elaborate plans for the water-works, and that he superintended the carrying out of the works, and, as far as they went, they were half completed. He went down constantly from London to Exeter for the purpose of superintending them. There was a large mass of correspondence between the plaintiff and the defendants as to the way in which the work was to be carried out. The defendants further alleged that although they employed the plaintiff, and although he must have done the work, they never entered into a contract under seal. This defence, he was happy to say, was in this case a wholly futile and idle one, because the Company was incorporated by an Act of Parliament which, by express terms, was to include the clauses of the Companies Clauses Consolidation Act, and one of these clauses provided that the Company should be able to enter into contracts in the same way as any ordinary individual. The defendants also set up another defence, which he would not say was never justifiable, but upon which judges and juries looked with some suspicion—namely, the Statute of Limitations. The defendants, in effect, said, "You have let years go by without pressing us for payment, and as soon as you hear we dispute your liability you bring this action; and we say these works were commenced and carried on for the most part some six years ago." This was quite true. The appointment of the plaintiff as Engineer took place some six years ago; it was true that the greater part of the work for which he charged was done before the middle of 1872, and the action was brought in June, 1878; but the Statute of Limitations provided that the action must be brought within six years after the cause of action had arisen. The question that had to be asked in every case was when the cause of action arose. The plaintiff was suing for compensation for service, and the question was when the money that was being sued for became due. The plaintiff was appointed the Engineer to superintend the erection of these works, and, according to the custom of engineers, he was to be paid for his work when his work was completed. So far from his work being at an end in 1872, he (the learned Counsel) would show, from a series of letters and resolutions by the Directors of the Company, that the plaintiff was called upon

to do certain work down to the end of 1876. It was not because the contractors failed to carry out their contract, and threw up the works for a time, that therefore the Directors threw up the work. On the contrary, they wished to get some other contractor to carry it on, and until the works were abandoned, or until the Directors told their Engineer that they did not want him to act any longer, he had no right to say, "I have completed my work, and have a right to demand payment." It was quite true that in these cases an engineer asked for payment on account. In 1872 and 1873, Mr. Humber wrote asking the defendants for a cheque for £100 on account. They gave him a cheque for a small amount; and in 1873 and 1875 they said in one case they were short of cash, and in the second case did not give any definite answer. Until the plaintiff was dismissed, or the works were given up in 1876 or 1878, he (the learned Counsel) apprehended that the plaintiff had no right to demand payment of his commission, and that therefore, so far as the Statute of Limitations applied, there had not been one year—certainly not more than two years—that had elapsed from the time the plaintiff had to bring the action. He therefore submitted that the defence was invalid. Another defence was that in the month of April, 1870, the plaintiff proposed to the defendants that he should be appointed by them their Engineer in making and erecting certain works upon the terms that the plaintiff should obtain persons to become subscribers, and that he should not make any charge in the event of subscribers not being obtained. The plaintiff was not suing for anything that happened in 1870. In 1871 the project was revived, and the question was what took place in 1871. Why the defendants should take the trouble to state that certain proposals were made in 1870, he did not understand. The defendants also said that in 1871 an agreement was entered into between the plaintiff and the Secretary of the Company. It was agreed that the plaintiff was to procure persons to contract with the defendants for the construction of the water-works, that the plaintiff was to be the Engineer, that he was to procure 100 shares to be subscribed for, and was to take 15 shares himself. They said that it was a term of the agreement that it was to be confirmed by the Board of Directors, and if the terms were not complied with, the agreement was to be null and void. The agreement was not confirmed by the Board of Directors; and, being null and void, he would ask what it had to do with the rights of the parties. Another counter-claim made by the defendants against the plaintiff was that he should pay £3000 because he had broken this null and void agreement; but as the plaintiff agreed that it was null and void, he (the learned Counsel) could not see the validity of the defendants claim. The defendants also said that the £175 which had been paid was enough to satisfy the claim of the plaintiff. He would be able to show, however, that 5 per cent. was the usual commission to be paid on a contract, if it was in London, whilst in farther-off districts it was 6 per cent., and that was what the plaintiff claimed; therefore the defence, as far as he could see, was an idle one. The question resolved itself into whether or not the plaintiff had been employed by the defendants to do their work. He supposed his learned friend would say that although it was true the plaintiff did this work, he did it on the understanding that he should not be paid for it unless they chose to pay him; but that was not a very probable defence, to begin with. Letters and minutes would be produced to show that the plaintiff was actually appointed the defendants Engineer, and that all the work was done by him in the usual way as their Engineer. The Company was originally started in 1868; but they found great difficulty in getting their funds subscribed, and in carrying out their works. Time went on until 1870, when a Mr. Smith, of Bristol, wrote to Mr. Humber and asked if he could give any aid in the matter. In getting a contractor for any works of this kind, a great deal depended upon who was the engineer. In the first place, the contractor had usually to take some of the shares in the company as part payment of the works executed by him; and the contractor would think twice before he took shares in a company which might be so badly engineered that it would not answer, and where he might not be able to sell the shares when the work was completed. Another reason why the contractor would consider as to who was the engineer, was because the engineer had to decide all questions between the contractors and the company as to the way in which the works would be carried out; and it was of great importance that the engineer should be a man in whom, in point of character and ability, the contractor could thoroughly trust. The defendants, therefore, called in Mr. Humber's assistance. Mr. Humber told them he did not think there would be much difficulty, if he were appointed, in finding some contractor who would carry out the contracts. As to the question of raising capital, he thought if he was allowed to look out for a Secretary to the Company, he could find some gentleman who would agree to take a certain number of shares. It was suggested that a Mr. Tomlinson would be the Secretary; but he finally declined. Then Mr. Humber had to go away to a very large work he was undertaking in Russia, and the whole matter fell through. In the autumn of 1870 he came back again, and wrote to Messrs. Gidley and Head, Solicitors, of Exeter, asking if anything more had been done in regard to the water-works. He was answered that there had not been, and was asked if any steps could be taken to carry out the works. It required a good deal of time for a busy man like Mr. Humber to go about and find a contractor to undertake a matter of this kind, and to find people to back it up by taking some of the shares. It was not likely that Mr. Humber would undertake all this, unless he knew what position things would assume in the end. On the other hand, the Directors not unnaturally wanted to see their way in the matter. A correspondence took place, which was the expression of the two parties as to what was fair and right, and, therefore, the various proposals beforehand were not strictly evidence. What took place afterwards was always understood. On the 14th of February, 1871, Mr. Humber and the Secretary of the Company, Mr. Serena, entered into an agreement to show upon what footing Mr. Humber was to set to work and try to find some contractor who was willing to undertake the works, and authorizing him (Mr. Serena), if he could, to place more shares on being given the position of Secretary, so as to have a certain amount of control in the transaction of the business of the Company. This agreement was the one which both parties agreed was null and void. It was dated Feb. 14, 1871, and it provided that Mr. Humber was to find a proper and responsible contractor or contractors, who would enter into a reasonable, fair, and proper contract for the construction of the water-works as far as related to Woodbury and Topsham, including the laying of pipes and all proper material and labour, &c., such contractor or contractors to receive for the work £2000 in debentures of the Company, £500 in ordinary paid-up shares, and the balance in cash. Mr. Humber was to be employed as Engineer to the Company for the purposes of this contract and the works incidental thereto, on the usual terms. It was further provided that Mr. Humber should procure persons to take 100 shares of the Company in addition to the 50 to be subscribed for by proper and responsible contractors, to enable them to carry on the business, and that Mr. Humber was to take 15 shares himself. There was also a proviso that he was to nominate a Secretary, and the Company were to ratify the nomination. Whether that part of the agreement was legal or not, he was not sure; because he doubted whether the Directors had a right beforehand to appoint a person to nominate their Secretary. The agreement concluded that it was to be confirmed by the Board of Directors, by Mr. Humber, and by the contractor or contractors; but if such conditions were not complied with, the agreement should be null and void. Mr. Humber succeeded in finding a contractor, and also a gentleman who undertook to place the 100 shares on his appointment as Secretary; but finally, the latter part of the agreement was not carried out, and the Secretary was not appointed; but the former part of the agreement was carried out. He (the learned Counsel) quite agreed that if the whole of the agreement was not carried out the Directors were not bound to carry out any part of it; but Mr. Humber found a contractor to do the work under the terms of the agreement. The Directors were satisfied with the contractor and the terms, and they therefore entered into a contract with Messrs. Hassell for completing the works. On April 19, 1871, Mr. J. Sampson, jun., wrote to the plaintiff, saying that he would undertake to place the 100 shares if the Company would appoint him the Secretary, providing that, supposing he failed to place the shares, the Directors would either return him the deposits on those he had placed, or appoint him Secretary notwithstanding that he had not placed the entire number. He was thereupon conditionally appointed, and his name subsequently appeared in the prospectuses; but it was understood that the appointment was not to be ratified unless he could place a reasonable number of shares. It seemed so probable that he could place the shares that the Directors thought they might safely go on; and accordingly on the 8th of June, 1871, a contract was entered into by the contractors, and it was, he thought, actually sealed by the Company two or three days later. It provided that the contractors should execute the works according to the specification, and that, until the Company should otherwise determine, Mr. William Humber should be their Engineer for the purposes of the contract. The agreement also provided for arbitration, and there was a final clause to the effect that the Company's Engineer or Engineers for the time being should, according to the specifications of works, certify, on the first of every month, while the works were proceeding, by writing, for the work done, that he should make every such certificate in duplicate, and deliver one part thereof to the contractors, and the other to the Engineer for the time being, &c. Then there was a proviso that the payments should be made on these certificates at the rate of 1-13th in shares, 4-13ths in debentures, and 8-13ths in cash, and another that the Company's Engineer or Engineers should be referees or arbitrators in all matters relating to the plans and drawings, and as to the sufficiency of works contracted for, or any part thereof. The Company appointed Mr. Humber as their Engineer, with the large powers given by this agreement, and instructions were given him to go down and witness the contractors sign the contract, and it was signed in Mr. Humber's presence shortly afterwards. On Aug. 10, 1871, Mr. Sampson was written to, asking him to give the names of the persons with whom his shares were placed. Mr. Sampson replied that the gentleman who had agreed to take them was dying, and that he was unable to place the shares. The Directors thereupon cancelled his appointment as Secretary. In the latter half of 1871, Mr. Humber was going down continually under the contract, watching the works, and was giving month by month, as Engineer, certificates of the work done, and the payments to the contractors were duly made under them. No suggestion was made, and could not have been made, that Mr. Sampson's failing to carry out his agreement to place the shares had anything to do with the appointment made by the Company of Mr. Humber as Engineer for the works. On December 9, 1871, Mr. Humber wrote to the Directors pointing out the necessity of their having a resident engineer or clerk of the works, to ensure the several works being properly carried out. After some correspondence, he appointed a clerk of the works, and offered to send one of his assistants to aid in carrying out the works on payment of his railway expenses, and an almost nominal sum by way of remuneration. At the same time he applied for a cheque for £50 towards the expenses he had incurred. On Jan. 6, 1872, the Board took Mr. Humber's letter into consideration, and a resolution was passed referring him to the terms of his agreement, and stating that the Company required all their capital to meet the contractor's demands. Mr. Humber replied on the 8th of January, saying he could not understand the drift of the resolution, that the Directors surely could not expect him to spend money time after time, and that he ought not to be put on one side, and the contractors have the preference, seeing that he had been the main instrument in promoting the works. On the 24th of January there was a very heavy rainfall, and some portions of the sides of the reservoir that was being made slipped, and it became necessary to take immediate steps to prevent any further damage. Accordingly Mr. Humber sent instructions to Messrs. Hassell to board up the sides of the reservoir, and to do what was necessary to prevent any further slips. The Engineer decided that this was extra work, and that, under the terms of the contract, they were entitled to be paid extra. On March 25, 1872, the Directors passed a resolution that £25 in cash and fifteen £10 shares be sent to Mr. Humber without prejudice to the agreement. On the 4th of April Mr. Humber wrote acknowledging this, requesting the shares to be entered as fully paid-up, also saying he was disappointed at not receiving a cheque for a larger amount, and asking for another cheque for £25. The Directors having learned that extras for keeping up the banks of the water-works had been incurred, they passed, on the 9th of April, a resolution to the effect that they could not recognize the right of the Engineer to give orders for extra works without consulting the Board on the subject, and submitting the plans for their approval. The plaintiff said, in reply, that he would usually do so, but in a case of this kind the work would have been destroyed if he had not taken immediate steps. On April 25, 1872, the Directors passed another resolution to the effect that, having reference to the conditional agreement of Feb. 14, 1871, especially to the clause "that the said William Humber shall procure 100 of the shares of the Company, in addition to the 50 to be taken by the contractor, to be subscribed for and to be taken by proper and responsible persons, so as to enable the Company to carry out the said contract, and shall take 15 shares himself," it was resolved that Mr. Humber's attention be called to the agreement in question, which, by reason of his having failed to carry out the conditions therein contained, had not been confirmed by the Board, and asking him to explain his conduct, the Board reserving full liberty of action when such explanation should be brought before them. The Directors further said that they had performed their part of the contract, and asked the contractors to perform theirs. He (the learned Counsel) did not know what the Board meant by that resolution, because the agreement of the 14th of February was not the one which appointed Mr. Humber as their Engineer. He had not found the shares, and he had not nominated the Secretary, and the agreement was not confirmed, and was, as far as he knew, waste paper. It would be found that no shares had been taken, except five, by a Mr. Davenport. On the 14th of May the contractors wrote to Mr. Humber, and claimed to have their certificates made out, not as certificates ordinarily are, of the work that had been done, but made out separately—the work that had been done under the terms of the original specification, and the extra work; their contention, as he understood, being that they were entitled to be paid for the extra work in cash, and not partly in shares or debentures. He thought the jury would be of opinion that this was really an excuse, because the price of iron in 1872 had gone up immensely, and therefore this contract to lay iron pipes did not answer the purpose of

Messrs. Hassell so well as they expected it to do, and they were rather glad of an excuse to get out of the contract. On May 14, 1872, they wrote to Mr. Humber that as he declined to furnish them with the details of his certificate, they had stopped the works and given notice to the Company. Messrs. Hassell, therefore, stopped the works, and took away as much of their plant as they could. Thereupon the Secretary of the Company wrote on the 15th of May, and the Managing Director (Mr. Gidley) wrote to Mr. Humber saying the Directors would hold Messrs. Hassell and Co. responsible for the non-carrying out of the works. That, however, was not treated by the Company as rendering the whole scheme abortive; but they set to work in the first place to complete the works sufficiently to prevent their compulsory powers lapsing, and they also spent a sum of money in completing the reservoir so as to prevent it being injured by the weather, and laid a pipe to the nearest house in Topsham so that water would be supplied to somebody. They proceeded, by a quantity of correspondence and a series of resolutions, to call upon the Engineer to take various steps with regard to the works and with regard to the contractors who had thrown up the work. There was a further correspondence as to whether the contractors were entitled to a final certificate, and Mr. Humber wrote to ask whether he should give it or not; and on May 31, 1873, the Directors passed a resolution that, under the circumstances of the contractors throwing up their contract, they were not entitled to any further certificate, and that the Engineer be directed not to give one. Mr. Humber wrote to Mr. Gidley on June 23, 1873, saying he was astonished to hear that the Company had commenced certain works without consulting with him, and that he would not be responsible for what was done, as it might jeopardize the whole works and interfere with their efficiency. It turned out that all that had been done was to lay a pipe to the nearest house to preserve their powers. Mr. Gidley wrote an apologetic letter, saying that the time for laying the pipe was too short to enable them to consult Mr. Humber in the matter. On the 18th of August the plaintiff wrote to Mr. Gidley, saying he would feel obliged by his informing him what the Company purposed doing, that the Company were largely indebted to him, and that unless an effort was shortly made to complete the works he must request a payment on account. He also pointed out that it was now twelve months since anything had been done. The Managing Director wrote on Aug. 19 to Mr. Humber, saying he would lay the letter before the next meeting of the Board, and adding that the Directors were not likely to reverse the answer they had already given to a similar application from plaintiff as to giving Messrs. Hassell a final certificate. On the 11th of December Mr. Humber wrote to Mr. Gidley again, saying he was surprised at not receiving a reply to his several letters, and that he must again beg of them to inform him what was likely to be done, with a view to complete the works so that they might be remunerative. He also asked for a cheque for £100 on account of his expenses, and added that if the Company wished it he could obtain the pipes for them on good terms, part to be paid in shares and part in cash. There was some further correspondence, and in 1874 there was a proposal by Mr. Shoplin, a contractor, to take up the works and complete them; but after three or four months negotiations, that fell through. In 1876 a Mr. Clark offered to complete one section of the works, but the Directors refused this, saying they must have the whole of the works done, or none at all. Mr. Humber began to think the time had come when the matter must be treated as abandoned, and that at any rate he was entitled, after the lapse of five or six years, to be paid the costs he had been out of pocket, and on May 18, 1878, he wrote to the Secretary enclosing his account, and asking that the same might be laid before the Directors at their next meeting. On the 30th of May he received a reply from the Directors that they denied all liability, and returning the account. They also referred the plaintiff to the letter of April 9, 1870, as well as to a communication made on April 25, 1872, at the instance of the Board. They also expressed their surprise that the plaintiff should attempt to set up any claim against the Company. This was signed by Mr. C. E. Davenport, as Honorary Secretary, who for the first time set up that Mr. Humber had no claim upon them. The defendants pleaded that the agreement entered into between the plaintiff and the Company, never having been confirmed by the Directors, was null and void. This was an outline of the case. It appeared to him that beyond all question the plaintiff had been employed as Engineer to make the plans of these works, to superintend them, to carry them out, to give certificates for them, and to arrange all matters about and concerning them, and this upon the usual terms. All the resolutions of the Directors one after another spoke of him as the Company's Engineer. The Directors wrote and gave him instructions as their Engineer, they paid on the certificates he had given as their Engineer, and it seemed to him (the learned Counsel) inconceivable that it should be doubted that he was employed by them to do the work.

The Lord Chief Baron: You say there is no contract between these parties in writing or otherwise about 1 per cent. or 5 or 6 per cent.; but you say that it is the usual thing; and you may perhaps contend that it is a reasonable remuneration for an engineer who acts as engineer to a company of this description?

Mr. Bompas: That is my contention.

The Lord Chief Baron suggested whether the case could not be referred to some legal arbitrator, with the assistance of an engineer.

Counsel having consulted for some time,

Mr. Bompas stated that his client was unwilling to undergo the expense of an arbitration.

The case was therefore allowed to proceed, and the following evidence was called:—

Mr. *William Humber*, examined by Mr. Bompas.

I am a Civil Engineer, carrying on business at 20, Abingdon Street, Westminster. I have had 40 years experience, and am the author of several works on the supply of water to towns. I have had the superintendence of large water-works abroad as well as in England. I was first introduced to Messrs. Gidley and Head in March, 1870. The Company was formed in June, 1868. Between March, 1870, and Feb. 14, 1871, I had a considerable amount of correspondence in relation to the affairs of the Company. On the 14th of February I entered into the agreement with Mr. Serena. I introduced Messrs. Hassell to the Company, and the defendants instructed me to negotiate with them as to a contract. I met several of the Directors at their office in Exeter, and received verbal instructions to prepare plans, sections, contract drawings, and quantities, and to negotiate with Messrs. Hassell for the construction of the works.

[Some discussion here took place as to whether the original agreement between Messrs. Hassell and the Company was stamped, because his lordship refused to admit a copy unless there was positive evidence that the original document was valid. Mr. Head, formerly Solicitor to the Company, was called to give evidence on the subject, and said to the best of his belief it was stamped; but this did not satisfy his lordship. Mr. Hassell, one of the parties to the agreement, offered to produce the original document for inspection. Mr. Nasmyth put in a minute of May 19, 1871, stating that letters received from Mr. Humber and Messrs. Hassell having been read, it was resolved that, Mr. Humber's estimate for contract No. 1 being £6140 by cash prices, and Messrs. Hassell's offer for the same work being £6507 14s., Mr. Humber be requested to see Messrs. Hassell, and endeavour to obtain an abatement of their tender, and, if possible, to get the same reduced to the amount of Mr. Humber's estimate, and to write Mr. R. W. Head the result of his interview forthwith, and that, subject to the reduction being satisfactory to Mr. Humber and the Directors, the contract with Messrs. Hassell be at once entered into. Several minutes were then put in, as also the correspondence relating to them, showing the relations between Mr. Humber and the Company, and his transactions with, and instructions to Messrs. Hassell, the contractors, the purport of which has been given in the learned Counsel's opening speech.]

Examination continued: I continued to work as Engineer under the contract with Messrs. Hassell, and from time to time gave certificates of the work done by them. The first certificate is dated Oct. 2, 1871, for £300, and the last certificate is dated May 8, 1872, for £255. There were in all seven certificates. [A list of the certificates was put in.] The reason I did not give any further certificates was because the contractors would not proceed with the works. They repeatedly asked me to give certificates, and they gave up the works in consequence of not being paid for extra work in cash, instead of debentures and shares. Down to the 14th of May I continued to do the work for which I have charged in the particulars.

By the Lord Chief Baron: I did the whole of this work at the request of the Managing Director of the Company, and the charges are fair and reasonable.

Examination continued: After the works were stopped, I negotiated for their being carried on by other contractors; but these negotiations fell through. The negotiations were also carried on at the request of the Managing Director. I applied from time to time for payment for my services.

By the Lord Chief Baron: From beginning to end I only received as payment £25 in cash and 15 fully paid-up £10 shares.

Examination continued: I have given the Company credit for the £175. [A list of letters was handed in from the plaintiff to the defendants, and from the defendants to the plaintiff, the first bearing date Dec. 9, 1871, and the last May 30, 1878.] The balance claimed by me is £408 13s. 3d.

The Lord Chief Baron asked Mr. Charles if there was any minute or resolution confirming the agreement of Feb. 14, 1871.

Mr. Charles said the only minute he would trouble the Court with was one dated Feb. 24, 1871, which approved of the agreement, and at a meeting of the Shareholders held on Aug. 21, 1871, at which the plaintiff was present, it was resolved that the Company should hold Mr. Humber responsible to place the 100 shares in accordance with his agreement.

Mr. Bompas here informed his lordship that Mr. Hassell had searched his papers for the missing original agreement, but could not find it, although it was believed to be in the safe of his solicitor, but that he would endeavour to have it by next morning.

Mr. Charles then produced some letters, in one of which the plaintiff wrote to Messrs. Gidley and Head saying that he was sorry to find the Directors took so little interest in the Company, as the delays were damaging to its prospects, and that he had no hesitation in stating that had the matter been settled when he met the Directors, everything would have been arranged, and some of the pipes laid before then. He had not the least doubt of placing the shares if it were done at once; but if it were delayed it would not be possible.

Cross-examined by Mr. Charles: I did not succeed in placing more than five shares, but the thing did not go on then. It was after the agreement of Feb., 1871, that I prepared plans and sections. I think, altogether, there were some fifty plans. [The witness was then led through several items in order to show his charges for the different services performed by him on behalf of the Company.]

In answer to the Lord Chief Baron, Mr. Bompas stated that £408 13s. 3d. was the amount claimed by the action.

The Lord Chief Baron: The question is whether, under the Statute of Limitations, you can recover £408 or £42?

Mr. Bompas: Yes.

Friday, April 23.

Mr. Charles produced an account sent in by the plaintiff on May 18, 1878, the various items in which amounted to the sum of £483 13s. 3d., and he was proceeding to cross-examine the witness upon it, when

The Lord Chief Baron asked if the parties could not agree on some sum. Assuming the Statute of Limitations would operate in favour of the defendants, what sum was the plaintiff entitled to recover?

Mr. Charles said matters had gone so far that he could not but lay his case before the jury. The defence was by no means confined to the Statute of Limitations.

The Lord Chief Baron: I know it is not; but I suppose that, sooner or later, if the plaintiff be entitled to recover anything at all, the jury will have to determine, unless you agree upon it, how much he is entitled to recover; and, as far as I can collect from the whole of the evidence in the case now, it is a sum between £400 and £500—that is, if no part of the claim be barred by the Statute of Limitations. Supposing the plaintiff, either under an express contract that he should be employed as Engineer—he having undoubtedly been employed, and having undoubtedly performed certain services as Engineer—be entitled to recover anything, either in one way or the other, under an express contract or under a *quantum meruit*, having done work and performed services, as far as I can understand it is either for some larger sum of £400 or £500, if the Statute of Limitations has no operation at all, or at least it is for the sum of £42. If you do not agree to that, go on.

Mr. Charles: I shall ask no other question on the details of the items.

Re-examined by Mr. Bompas: The writ in this action was first endorsed for £483 13s. 3d. Afterwards I found it ought to have been £583. One of the items—£31—is for giving notice to the landowners, and for plans showing that the pipes would go through their lands. The sum charged for the total amount of work was £2825, and not £3805. The 3 per cent. on £3805 ought to be on £2825. It ought to be £84 15s. instead of £114. The £67 10s. is actual expenses I paid out of pocket.

The Lord Chief Baron: Do you, as an Engineer, after 40 years experience, say that this is a fair, just, and reasonable charge?

Witness: I do. I have allowed for 15 fully paid-up shares, £150.

The Lord Chief Baron (to Mr. Bompas): Does the result, according to your calculation, and consequently the claim you make upon the defendants, come to this, that supposing the Statute of Limitations to operate on all the items before June 18, 1878, the result is that still, reckoning four or five sums I took down from Mr. Charles, the amount then, and the only amount that would remain, would be £42?

Mr. Bompas: Yes.

Mr. Charles: We both agree to that—the amount claimed.

Mr. Bompas (to witness): Where an engineer is employed to superintend works like these, when does his payment become due?

The Lord Chief Baron: It is according to the contract between himself and the company, for which he acts as engineer. It may be that the whole is not payable until the work is complete, upon which he charges a certain percentage. It may be that there is no specific contract at all, and that from time to time he claims and receives sums of money on account; but it depends upon the contract.

Mr. BOMPAS: Of course, if there is an express contract which depends upon it; but surely, if a person is employed generally as engineer, it is the custom?

The LORD CHIEF BARON: There is no custom on the face of the earth that applies to this case. There is no specific appointment under the seal of the Company, or under any contract between the plaintiff and the Company, that he shall, with certain remuneration, be employed as Engineer, and have the effect of creating him Engineer to the Company under that contract. There is no such contract in existence, but there is a great deal of evidence of what purports to be a contract, to which the Secretary of the Company is a party. And again, as to the contract, which has not yet been before me, but which I may assume to be in existence and bearing a sufficient stamp, it appears from the evidence over and over again that he is Engineer to the Company. *De facto*, the plaintiff was for a length of time acting as Engineer. Under those circumstances, whatever may be the evidence, unless there is something of which we have no conception, I shall direct the jury that there is no contract which specifies any particular sum, or enables them to determine upon any sum to which the plaintiff is entitled, and no special time at which those sums shall be payable. His services were to be performed by contract between the Company and the contractor, which contract was never in existence. The point of law is that, as undoubtedly the plaintiff has performed certain duties as Engineer from time to time during a long period, whether such a period is within the Statute of Limitations, and he is entitled to recover for services he has actually performed under the authority and at the instance of the Company as their Engineer.

Mr. BOMPAS was again about to put his question, when

The LORD CHIEF BARON said he could not admit it. The learned Counsel might ask the plaintiff what he had actually done as Engineer, and whether the communications with the Directors were verbal or were made in writing.

Mr. BOMPAS cited the case of *Whitehead v. Lord* (21 *Law Journal*, Exchcq. 239), where a man was employed as a solicitor, and although the action might go on for six or seven or ten years, yet he was entitled to six years from the conclusion of the suit.

The LORD CHIEF BARON differed from this view.

Mr. BOMPAS said he would therefore leave the case as it was.

In answer to the LORD CHIEF BARON, witness stated that he charged 2½ per cent. on the works and ½ per cent. for his extra time going down to Exeter.

The LORD CHIEF BARON: It appears that the plaintiff never entered into a contract binding himself and the Company for any specific sum for what services he may have rendered as Engineer, except the one contract to which I have referred. That is the contract in which he says he should obtain a sum in cash, and place 100 shares. Yet, although there was no such contract in existence, he performed services as Engineer, and for the amount of those services from the time he began to act as Engineer down to the time he ceased so to act he has a perfect right to recover from the Company for his services, subject to the Statute of Limitations—that is, within six years of June 18, 1872.

Mr. *William Dennis*, examined by Mr. BOMPAS.

I am a Civil Engineer, and my offices are at 3, Victoria Street. I have been in practice for over 20 years, and have been Engineer to various large undertakings in water-works and railways. I have looked through the plaintiff's account, and in my opinion the charges are fair and reasonable.

Cross-examined by Mr. CHARLES: I have not seen the works in question, nor have I examined the original plans and sections of the Engineer of the Company. I have not seen the plaintiff's plans. My opinion as to the reasonableness of the plaintiff's bill depends upon the general custom of the profession.

Mr. BOMPAS: If an engineer is engaged by a company as the engineer of their works, and nothing is said by either party as to the time when his employment is to cease, would it, by the practice of engineers, be an engagement for the whole of the works, or for any shorter time?

The LORD CHIEF BARON took a note of the question, but said he must overrule it as inadmissible.

Mr. BOMPAS said that his learned friend and himself had agreed that the whole of the correspondence on both sides, and set out in the affidavit of documents, should be considered as put in, as also the minute-books, in case at any time they should be referred to.

This concluded the case for the plaintiff.

Mr. CHARLES intimated that he would call a witness previous to making his speech.

Mr. *Silvanus Wm. Jenkin*, examined by Mr. JONES.

I am a Member of the Institution of Civil Engineers, and carry on business at Liskeard, in Cornwall. I have had experience with respect to water-works for 20 or 25 years. I was employed as Engineer to the Topsham Water-Works Company previous to their application for parliamentary powers. I drew the plans for the purpose of the application to Parliament. After the Company had been incorporated I prepared the whole of the land plans, and all drawings and specifications for carrying out the works. I also prepared plans for the purpose of tenders being sent in for acceptance. I have recently visited the site of the reservoir at Topsham, and about a fortnight ago I inspected the work so far as it has been constructed. I did not see the works on or about May, 1872. I never saw any of them until about a fortnight since. I have not seen the works that have been executed since Mr. Humber was Engineer.

Mr. CHARLES then addressed the jury on behalf of the defendants. He asked them carefully to consider the agreement as evidence of what it was the plaintiff was appointed to do. The plaintiff was Engineer of the Company for a particular and specified purpose. He was to find the contractor, and when he had found the contractor he was to be the Engineer of the contract. He was to do a number of other things which he admittedly had not done. He found a contractor in Mr. Hassell, who entered into a contract on June 8, 1871, for the building of the water-works. That contract was entered into between the Company and Mr. Hassell; but the plaintiff was not himself a party to it. It was important to observe that the plaintiff was described as the Engineer for the purposes of that contract, and there was no doubt that he was. The work commenced, and from time to time, between the month of June, 1871, and May, 1872, some work was done, and certificates from time to time were given in the usual way by the plaintiff. The plaintiff felt himself unable to place the shares, which he supposed he could easily have done. He only succeeded in placing five shares. The consequence was that in the month of May, 1872, the contractor became dissatisfied, and a dispute had also arisen as to some extras Mr. Humber had certified for. On that account, and on account of the difficulty experienced in obtaining cash, the contractor became dissatisfied. On May 14, 1872—a date which was very material for his case—the works were stopped. Messrs. Hassell cleared off their plant, and went away altogether, and there was, so far as their contract was concerned, an end of it altogether. Their main reason for adopting such a course was, no doubt, that they could not get paid, and this was on account of the capital not having been provided. The Directors were then left with nothing but a reservoir partly or wholly completed, and from that day to this nothing whatever had been done except the making of the reservoir good against the weather; and, in order to keep alive their parliamentary powers, the laying by the Company themselves of one pipe to a cottage in the village of Topsham. What he submitted was that whatever the employment of the plaintiff was, and whatever the terms of his remuneration were, his employment was at an end in May, 1872, because at that date the contract was finally abandoned by the contractors. On the plaintiff's own showing nothing was done at the place afterwards, except making the reservoir safe against the weather. He (Mr. Charles) would admit at once the correspondence between the parties from 1873 and 1874 up to 1878; but what was the end of it all? Just the same as the beginning. The plaintiff could not get, during those years, any other contractor to take the matter up, nor did he succeed in placing the share capital. In regard to the Statute of Limitations, he submitted that in this case it was a meritorious defence to the action. He did not blame the plaintiff for not finding the capital; but it was because he did not find it that the Company's contractor never finished the work, and went out in May, 1872. He held that the Company had as much right to complain of Mr. Humber, for not finding the capital, as Mr. Humber had to complain of them. Thus matters stood up to May, 1878, when the plaintiff presented his claim. Upon various occasions prior to May, 1872, he had pressed the Directors for payments on account, and in April, 1872, he had received a payment from the Directors, although they were greatly dissatisfied at his not having carried out his obligations under the agreement. They gave him 15 fully paid-up shares, amounting to £150, and a cheque for £25 in cash, and these shares had been credited by the Company as fully paid-up shares. From May, 1872, up to the present time the Directors had not paid the plaintiff anything, and denied their liability to pay anything in reference to the services he rendered. The plaintiff sought to recover £583 13s. 3d., giving credit to the Company for £175 paid to him in cash and shares in the month of April, 1872. This reduced the claim to £408 13s. 3d., and the jury would be the judges as to whether it was a fair and reasonable charge. Dealing with the items, he could not help suggesting that Mr. Humber, although he might not mean it, was endeavouring to recover some of them twice over. He started with a special item for surveying the site of the reservoir in February, 1871, and then gave another item for preparing 31 land plans, and for other purposes, for which he charged £31. Then came a lump sum for preparing the contract drawings, &c., 3 per cent. on the whole of the estimated contract price. Was it reasonable that a man should charge 3 per cent. on the estimated price of a contract which was not performed? The question was, what was his labour fairly worth? He had charged 3 per cent. upon the whole £7611, and then 3 per cent. more. In addition to this, there was a charge for out-of-pocket expenses. He had charged 6 per cent. upon the price of the executed works—£2825; and, in addition to this, he put other items in the beginning of his account.

The LORD CHIEF BARON: Upon the £3805, 3 per cent. would be charged twice over.

Mr. CHARLES: Yes; upon £3805 he charges 6 per cent.

The LORD CHIEF BARON: But upon the residue he charges only 3 per cent.

The LORD CHIEF BARON: Then there is the expense of journeys and assistance he required, and other matters. There is a considerable portion of it on which he charges 3 per cent., and not 6; and if he, in an ordinary way, is allowed to charge 6 per cent., it is for the jury to say why he did not charge that.

After some discussion as to the percentage charged,

The LORD CHIEF BARON said he should tell the jury that the plaintiff was not responsible for the breach of contract or the misdeeds of the contractors, and that if they left part of their work unfinished it did not affect his claim, unless by having left a portion of it unfinished they left a portion of his duties unperformed also. The whole claim was subject to the question of the Statute of Limitations.

Mr. CHARLES said his argument was that the plaintiff was superintending Messrs. Hassell's contract, and that in so far as he was superintending that contract down to the month of May, 1872, he had charged for superintendence 6 per cent. upon the works they executed; but in addition to that he had charged a sum of £62 10s. and of £30, or £100 more, in addition to his full 6 per cent. He submitted that these percentages should not be paid unless the jury were satisfied that the plaintiff had done the work which the percentages represented. The result of the whole matter was that the plaintiff had made out his bill upon two principles. Two of the items were made on the percentage principle, and the remainder were made out on the ordinary work and labour principle.

The LORD CHIEF BARON said that it involved the loss of time and labour in travelling from one place to another.

Mr. CHARLES, in conclusion, said the question was simply how much the plaintiff ought to receive for labour done both before and after the month of May, 1872.

Mr. BOMPAS having replied,

The LORD CHIEF BARON summed up the case to the jury. After dealing with the facts and figures, and explaining the bearing upon the case of the Statute of Limitations, he left it to the jury to decide what was the real arrangement between the plaintiff and the defendants; and what amount, if any, and subject to the Statute of Limitations—if they should think it was so subject—the plaintiff was entitled to.

The jury having retired, returned into court in about half an hour with a verdict for the plaintiff for £309 14s. 11d., and stating that they considered his claim had not been barred by the Statute of Limitations.

Miscellaneous News.

LARGE GASHOLDER-TANK AT THE SOUTH METROPOLITAN GAS-WORKS.

Towards the close of last year our readers were informed that tenders were invited for the construction of a large gasholder at the works of the South Metropolitan Gas Company in the Old Kent Road. The excavation of the ground and the construction of the tank for the holder have been for some time going on, and the work has made so much progress that some definite idea may now be formed of its magnitude.

The tank is 218 feet in diameter, and 55 ft. 6 in. in extreme depth, with a working depth of 54 feet. The wall of the tank is 5 feet thick at the bottom, tapering to 3 feet at the top.

The tank is being built entirely of concrete, without puddle; and the materials employed are rough clinkers, sand, and gravel obtained in the excavation, mixed with old fire-bricks from the retorts in the proportion of 7 parts to 1 of cement. The walls of both tank and cone are rendered with an inch thick of neat cement, closely trowelled.

In making the excavation, water was met at about 12 feet from the surface, and, in order to keep the working dry, six pumps have been employed—three 15-inch and three 18-inch—driven by two fixed engines of 25 and 40 horse power respectively, capable of throwing 3000 gallons

of water per minute; the sump-hole being 10 feet in the chalk, or 65 feet from the finished ground level.

The inlet and outlet pipes for the holder are each 4 feet in diameter, and have no dry wells; while, instead of the usual syphon wells, there are two 6-inch pipes rising to the level of the tank, and having in them 3-inch lifting-pumps for drawing off the water of condensation.

The holder for which this magnificent tank is being prepared will be a 3-lift one, rising 160 feet, and its working capacity will be 5,400,000 cubic feet. The constituent parts of the holder are already upon the ground, and as soon as the tank is ready for its reception—which it is believed will be by the middle of June—the work of erection will commence. The contract cost of the tank and holder, when complete, with the necessary inlet and outlet pipes, valves, &c., will be under £46,000.

The work was designed by Mr. G. Livesey, assisted by his brother (Mr. F. Livesey) and Mr. Somerville. The contractors for the tank are Messrs. T. Docwra and Son, while the erection of the gasholder has been entrusted, as our readers have already been informed, to Messrs. Ashmore and While, of Stockton-on-Tees.

THE PROPOSED GAS APPARATUS EXHIBITION IN GLASGOW.

After having been frequently spoken of during the last few months, the proposed gas apparatus exhibition for Glasgow was formally brought under the notice of the members of the Philosophical Society of Glasgow at the concluding general meeting held last Wednesday evening. Dr. W. Wallace stated that he was prepared to make a motion on behalf of the Council, but, since it might be regarded as a money vote, he proposed that the rule of the Society as to notice be suspended, in order that it might be considered at that meeting, and thus expedite the business by requiring only one other meeting to confirm it instead of two; and he moved accordingly. He also moved—"That, in the event of the exhibition-fund of 1847, now in the hands of the Corporation, being made available as a guarantee, the Society approve of the Council taking all necessary steps for holding an exhibition of gas apparatus, &c., in the autumn." The motion was seconded by Mr. John Mayer, F.C.S., who stated that, from the experience which he had acquired in connection with other gas exhibitions, he was satisfied that many firms in all parts of the kingdom were looking forward with some degree of interest to the proposed exhibition in Glasgow, at which they were specially desirous of showing off their inventions. There being no objection to the suspension of the Standing Orders, the motion was passed unanimously.

Dr. Wallace subsequently explained that the subject had been before the Council for several months, and he indicated the scope of the proposed exhibition, which, he thought, should be something more than a mere collection of cooking-stoves. If carried out in the comprehensive manner aimed at, it will most probably embrace a very complete series of apparatus and appliances illustrating the following:—(1) The manufacture, purification, and storeage of gas. (2) The regulation of pressure, and the measurement of gas. (3) Photometry of gas and other sources of light. (4) Gas lighting. (5) Heating by gas—stoves for heating and cooking. (6) Gasoline machines for making gas for private houses, &c. (7) Gas and gasoline engines. (8) Lighting by candles, petroleum, and paraffin. (9) Paraffin for heating and cooking stoves. (10) Secondary products of gas manufacture—benzole, dyes, &c. (11) Electric lighting. (12) Electric communication—telegraphs, telephones, &c. (13) Water-engines and meters. (14) Ventilation and heating of public buildings and private houses.

The exhibition-fund mentioned in Dr. Wallace's motion is a sum of £1000 or £1200 accruing from an exhibition held in the winter of 1846-47, under the auspices of the Philosophical Society and the Town Council, and invested in their joint names, and only to be employed "for a similar purpose." Hitherto the Council of the Society have never been able to get the fund into their possession for any of their schemes, but it is confidently hoped that at least one-half of it may now be obtained absolutely as a guarantee-fund for the exhibition which it is proposed to hold.

EDISON'S HORSESHOE LAMP *VERSUS* GASLIGHT.

The last number received of the *Scientific American* contains a report, by Professor Henry Morton, Professor Alfred M. Mayer, and Mr. B. F. Thomas, on "Some Electrical Measurements of One of Mr. Edison's Horseshoe Lamps," in which they say that much has been written and said within the last few months on the subject of Mr. Edison's new horseshoe lamps, and with all the writing and saying there has been wonderfully little produced in the way of precise and reliable statement concerning the simple primary facts, a knowledge of which would give the means of estimating both the scientific and commercial status of this widely discussed invention. It was, therefore, with great pleasure that they found themselves placed in possession of one of the horseshoe lamps of recent construction; and to satisfy themselves as to the real facts of the case, they soon made a series of careful measurements and determinations. They also state that a further examination of other lamps would have been made at the same time had opportunity offered; but as a communication on this subject addressed to Mr. Edison did not evoke a reply, they were obliged to content themselves with the one lamp as a subject of experiment. They, however, remark that the behaviour of this lamp under the tests, and the agreement of its results with information otherwise obtained, convinced them that it was at least a fair specimen of the lamps of this form so far produced at Menlo Park.

After detailing their mode of determining the amount and character of the electric current needed to operate the lamp efficiently, they described their arrangements for measuring the resistance of the horseshoe while in actual use, and emitting different amounts of light; also the quantity of current flowing under the same conditions. Having done this, they had all the experimental data required for the determination of the energy transformed or expended in the lamp, expressed in foot pounds. These worked out gave 0·08 (about 1-12th) of a horse power as the energy expended in each lamp. That is, in other words, one horse power would operate 12 lamps of the same resistance, with an average of 10-candle power each, or 120-candle power in the aggregate.

The photometrical measurements were in all these cases taken with the carbon loop at right angles to the axis of the photometer; and this was, of course, much in favour of the electric lamp, for, on turning the lamp round so as to bring the carbon loop with its plane parallel with the axis of the photometer—*i.e.*, the edge of the loop turned towards the photometer disc—the light was greatly diminished, so that it was reduced to almost one-third of what it was with the loop sideways to the photometer disc. The illuminating power, in the best position, was recorded as 15 candles; and in the worst, as 5 candles. The average or general illuminating power was, therefore, reckoned, as above, at 10 candles.

Assuming, then, that a Siemens or Brush machine were employed to generate the electric current, such a current would be obtained (as has been shown by numerous experiments) with a loss of about 40 per cent. of the mechanical energy applied to the driving pulley of the machine. To operate the 12 lamps, therefore, more than 1-horse power would have to be applied to the pulley of the machine, so that when this loss in transformation had been encountered, there should be 1-horse power of electric energy produced. This would call for 1¾-horse applied to the pulley of the dynamo-electric machine by the steam-engine. Now, to produce 1-horse power in a steam-engine of the best construction, about 3 lbs. of coal per hour must be burned, and therefore for 1¾-horse power 5 lbs. of coal must be burned. On the other hand, 1 lb. of gas coal would produce 5 cubic feet of gas, and leave, besides, a large part of its weight in coke, to say nothing of other residuals, which would represent practically about the difference in value between "steam-making" and "gas-making" coal, so that it would not be unfair to take 5 lbs. of gas coal as the equivalent of 5 lbs. of steam coal. These 5 lbs. of gas coal, then, would yield 25 cubic feet of gas, which, if burned in five gas-burners of the best construction, would give from 20 to 22 candles each, or 100 to 110 candles in the aggregate. There would therefore be 12 Edison lamps producing 120 candles, and 5 gas-burners producing 100 to 110 candles, with an equivalent expenditure of fuel.

In respect to this result, the report concludes: "If each apparatus and system could be worked with equal facility and economy, this would, of course, show *something* in favour of the electric light; but when, in fact, everything in this regard is against the electric light—which demands vastly more machinery, and that of a most delicate kind; requires more skilful management; shows more liability to disarrangement and waste; and presents an utter lack of the storeage capacity which secures such a vast efficiency, convenience, and economy in gas—then we see that this relatively trifling economy disappears, or ceases to have any controlling importance in the practical relations of the subject."

NORTH OF ENGLAND GAS MANAGERS ASSOCIATION.

The Sixth Half-Yearly General Meeting of this Association was held at Newcastle-on-Tyne, on Saturday, April 24. Mr. W. Ford, of Stockton-on-Tees, the President of the Association, occupied the chair. The following members were present:—Messrs. G. A. Allan, Willington; W. Allan, Stockton; J. Allen, Morpeth; W. Ashmore, Stockton; R. Brown, New Cumnock; H. T. Burrows, London; Isaac Carr, South Shields; R. Chapman, South Shields; G. T. Chinnery, Redheugh; R. Clapham, Newcastle; W. Cowley, Spennymoor; J. H. Cox, Sunderland; E. Crewdson, Middlesbrough; R. Denton, Jarrow; A. Donaldson, Edinburgh; J. Eadington, Blyth; R. Field, Bishop Auckland; W. Hardie, Newcastle; W. Hardie, jun., North Shields; G. H. Haswell, Tynemouth; J. Hepworth, Carlisle; J. W. Hepworth, Coventry; Matthew Hall, South Shields; J. T. Joliffe, Sunderland; W. Joures, South Shields; Joseph Mackay, London; Robert Main, Glasgow; Robert Moodie, Redheugh; Thomas Mossman, West Hartlepool; D. M. Nelson, Glasgow; J. Pattinson, Newcastle; J. H. Penney, South Shields; J. Robinson, South Shields; G. Rogers, Hexham; J. Rollo, Newcastle; J. A. G. Ross, Newcastle; Samuel Rutter, Brampton; C. Sellers, York; Roger Shotton, North Shields; W. Smith, Darlington; T. Trewhitt, West Hartlepool; G. Warner, South Shields; W. J. Warner, South Shields; Duncan Wemyss, South Shields; N. White, Jarrow; James Whyte, Seaham; Wm. Whyte, Jarrow; J. Woerth, Stockton; J. Wright, Stockton.

The Secretary (Mr. W. Hardie) having read the notice calling the meeting, the minutes of the previous meeting, which had been printed and circulated, were taken as read, and confirmed; and the accounts of the Association, which showed—after investing £139 in Newcastle and Gateshead Gas Company's stock—a balance of £43 7s. 3d. in the hands of the Treasurer, were adopted.

The following were elected Members of the Association, viz.:—

Nathan White, of Messrs. Palmer's Gas-Works, Jarrow; Wm. Cowley, Secretary of the Spennymoor and Tudhoe Gas Company.

And the following an Associate, viz.:—

Robert Woerth, of Stockton, Engineer.

Some discussion took place in reference to the days fixed in the rules for meetings.

Mr. Warner moved that the meetings of the Association be held in the last week of April and the first week of October in each year, but that the particular days of such meetings be left to be settled by the Committee.

Mr. Trewhitt seconded the motion.

Mr. Hepworth moved, as an amendment, that the rules respecting the days of meeting remain as at present, with this addition—"or such other day in the same week as may be agreed upon."

Mr. Cox seconded this amendment; but, on a division being taken, Mr. Warner's motion was carried.

Mr. Warner then referred to the great assistance he received last year, when President of the British Association of Gas Managers, from the President and Secretary of the North of England Association, to whose exertions, he said, the success of the Newcastle meeting was in no small degree due, and he took this, the first opportunity of thanking them.

The President acknowledged the compliment on behalf of himself and the Secretary. He then referred to the death of Mr. Irvine, the Manager of the Ripon City Gas-Works—a member of the Association. Mr. Irvine, he said, also had charge of the water-works, but unfortunately his health failed. He had great experience as a practical engineer, and was highly esteemed by all who knew him. He (the President) further stated that before he left the chair he had a pleasing duty to perform—namely, to present Mr. William Hardie, jun., with Miller's "Elements of Chemistry," being the prize awarded to him for the best paper read at their meeting last April. When he read the paper Mr. Hardie was an assistant at the Newcastle Gas-Works, but since that time he had been appointed to the management of the Tynemouth Gas-Works. He was sure all the members of the Association wished Mr. Hardie, jun., success and prosperity in his new undertaking.

Mr. Hardie, jun., briefly returned thanks.

The Chairman announced the result of the voting for officers for next year as follows:—

President—Mr. J. H. Cox.
Vice-President—Mr. T. Trewhitt.
Committee—Messrs. J. Hepworth, C. Sellers, W. Smith, and S. Studholme.
Auditor—Mr. J. H. Penney.
Secretary—Mr. W. Hardie.

On the motion of Mr. Hepworth, seconded by Mr. Trewhitt, a vote of thanks was passed by acclamation to Mr. Ford for his services as President during the past year.

It was unanimously resolved that the October meeting be held in Sunderland.

This concluded the ordinary business of the meeting.

The Members and Associates then proceeded by rail to Jarrow, on a visit to the South Shields Gas Company's new works. They were met by Mr. Henderson, Mr. Robinson, and Dr. Armstrong, Directors; Mr. Warner, Engineer; and Mr. Penney, Secretary of the Company, and conducted over the works. The new stoking apparatus invented by Mr. Warner was set to work, and all present had ample opportunities of inspecting it, even to its minutest details. After having surveyed the other portion of the works, the company were invited to the purifying-house, where Mr. Warner gave the following explanation of his invention:—

Before describing the machinery, I invite you to a brief consideration of the work of the retort-house, and to the modifying influence of machinery upon that work. By thus dealing with the matter, we may be better pre-

RAKE. SCOOP.

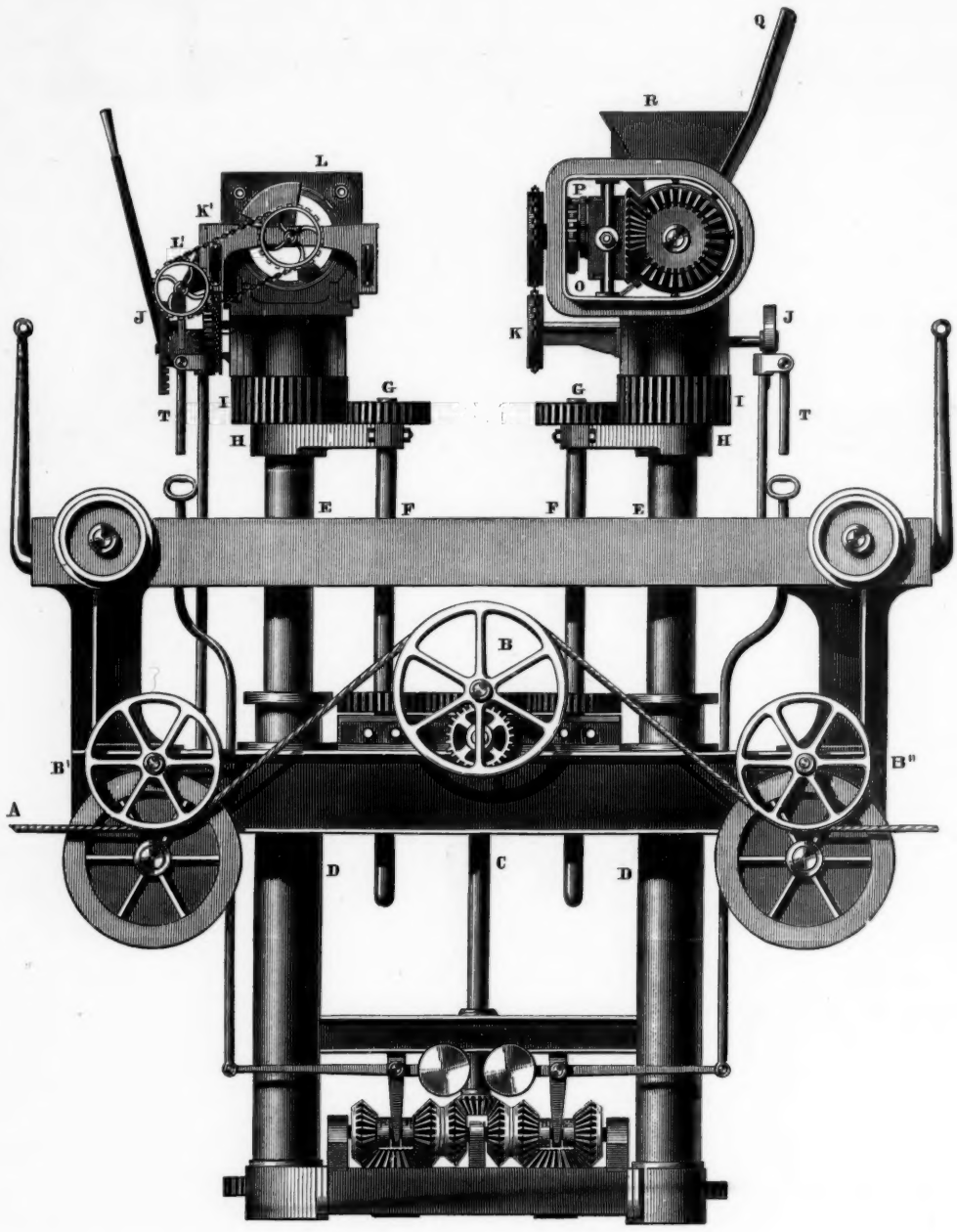


FIG. 1.—*BACK END VIEW.*

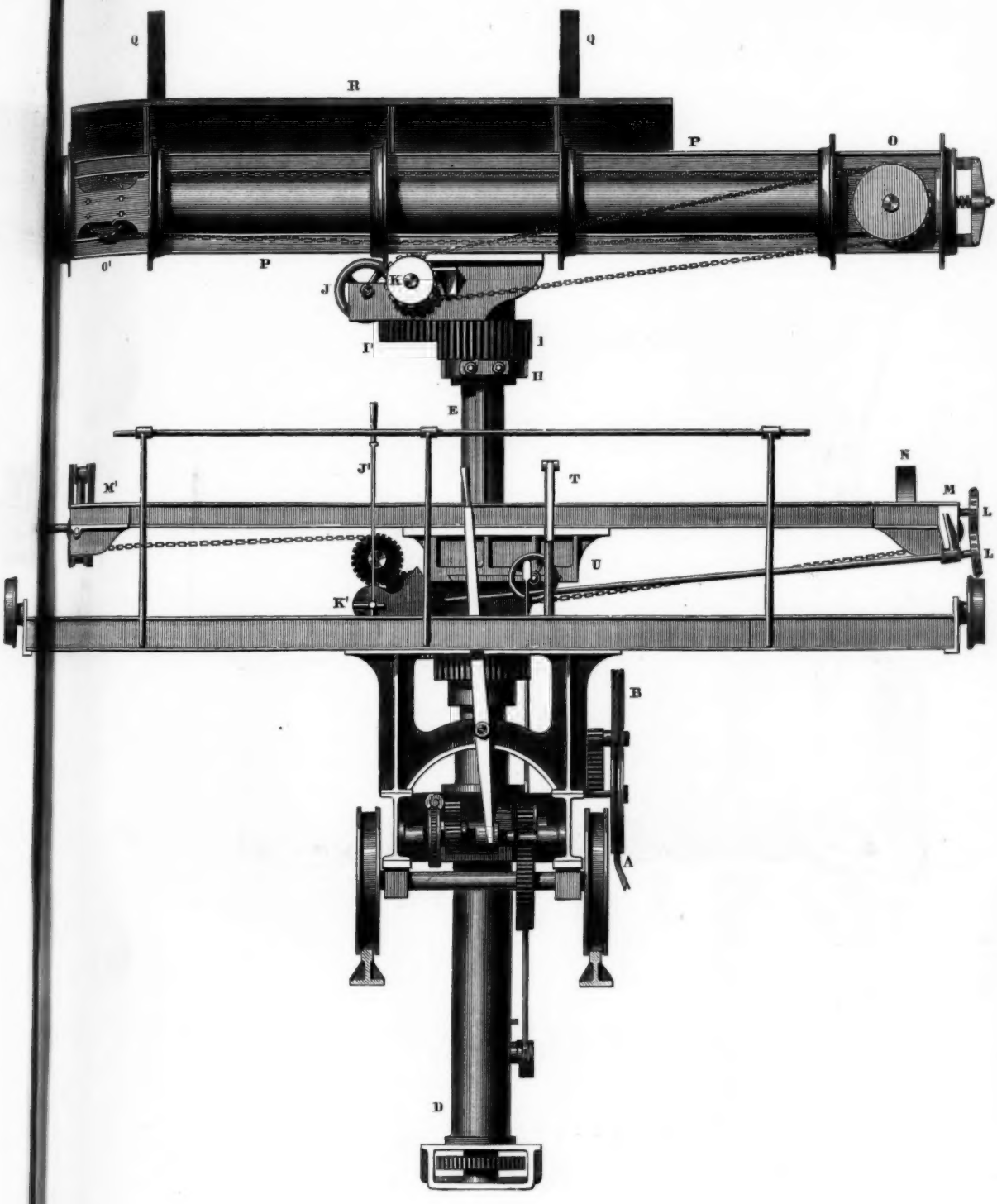


FIG. 2.—*SIDE VIEW.*

CHA NG AND DRAWING GAS-RETORTS.

pared to judge of the fitness of the several arrangements for the work, and to examine whether they are adaptable to the varying requirements of different coal, make, and retort-houses. The work usually carried on in an ordinary retort-house may be said to be included in drawing and charging, all of the operations being intermixed. Thus the retort is drawn, then left for the removal of the coke; the charge is then prepared, and the retort is returned to for charging—the whole being only several portions of one operation. With stage floors we find, of necessity, a more systematic course of working. As the coke is drawn it falls to the vaults beneath; hence the removal of the coke does not interfere with the other operation, and as the charges are more or less prepared, we find the whole work thus divided into three operations. The more these are separated, the more systematic and economical will be the work of the present mode of carbonizing. To the system of carbonizing I have given considerable thought. Years since I submitted to the Directors of the South Shields Gas Company a plan which would have entirely changed the character of our operations. Many other schemes, more or less complete, I have devised, but I have found my way back to the old plan of horizontal retorts, good heats, fair charges, and of the ordinary duration. The retorts I use—18-inch circular—are nearly the same in dimensions, and I may say are quite the same setting as those I have had in use at Shields for the past 16 years. With these retorts, Mr. Carr, the Superintendent at Shields, has been getting from 5000 to nearly 6000 cubic feet of gas per mouthpiece through the winter, 50 per cent., too, of the settings being single. I need scarcely say that this was with 6-hour charges. Probably I should not have mentioned this, but upon a visit being paid to these works a short time ago, by an Engineer of very large experience, exception was taken to the employment of circular retorts. As the tools I use for drawing and charging are but the rake and scoop, they can work any ordinary form of retort; therefore, in my case, the matter simply resolves itself into a comparison of the machinery with the ordinary labour. Indeed, in every case of investigation of this character, I think this course should be adopted—the carbonizing separated from the manipulation, unless a new principle is introduced, in which one is an essential portion of the other. The machinery for charging and drawing must be considered and judged upon its own merits, as must also the form, size, and proportion of retorts, the weight of the charge, and its duration; and all these matters can and should be kept free from any other influence affecting the quantity and quality of the gas. As the ordinary settings, or number of retorts in a bed, are limited to the height of a man, the arrangements that have been made for increasing the power of the bed by adding to its height have, of necessity, been of a limited character. In this respect, and probably in this more than in any other way, the introduction of machinery into the retort-house will exercise a considerable modifying influence upon the working. Comparisons must often be made, and not to our credit, perhaps, by those not familiar with our operations, between the height of our buildings and those of other manufactures. Doubtless the contrast is very striking, and I have no doubt a change will be brought about. Indeed, I purpose working in this direction. Considerable advantage will arise from this alteration of plant, as well as economy of working, and it will materially affect the comparative cost of machinery. For example, if the cost of machinery for working a bed of sixes is £20 per mouthpiece, a bed of twelves would be reduced, the machinery being the same, to £10 per mouthpiece. I need scarcely add that, in moderate-sized works, a modification of the chambers and flues of the settings would be necessary in most cases if such powerful beds were in action; and perhaps in beds of considerably less power such arrangements might be made with advantage, and dampers used to our profit and convenience. But, of course, in this departure from our present practice, relative proportions would have to be observed, as they are in the present settings. I am not recommending any particular number of mouthpieces to a bed, but simply indicating what I think will be one at least of the modifying effects of the introduction of machinery into the retort-house. Again, I look for a considerable alteration of the working of moderate-sized or comparatively small houses. With machinery, the labour will remain constant both summer and winter in each house, the minimum of labour being sufficient with the machinery for the maximum make. Another modification will be hastened on by this question of machinery—I allude to the gas furnace, as it will simplify the operations of heating, getting rid of the firing, and cleaning of the furnace. But this work may be done with advantage by the machinery, and I am making arrangements to do it. To return to the working, we have, then, three distinct operations—systematic preparation of the charges, drawing and charging, and delivering of coke. Let us consider them in their order. First, the preparation of the charge. Assuming the coal to be that of our locality, and unscreened, it will be necessary to break the large pieces, and then to fill the scoop, or charge the retort direct. In the latter case the operation of charging seems to be involved in that of preparation, and less comparable with machine work. In the former we fill the scoop with suitable coals, and the work is complete. In attempting this work by machinery, it will be found that not only has the coal to be broken and put into the scoop, but the machinery must be made adaptable to work a changing quantity of coal. The man with a shovel naturally adapts himself to the varying quantity, and so the machinery must act alike upon any quantity of coal. The plan which I have adopted is to draw the coal out from the bottom of the bunkers into a scoop or its substitute. The machine, which consists of a revolving shaft, with arms radiating from it, works out the coal, breaking the large pieces at the same time. With this arrangement it is thought, from an experiment made the other day, that a ton per minute can be put into charges. Secondly, charging and drawing by hand—this operation may be said to commence with the lifting of the scoop. With the machinery I prefer to consider the raising of the scoop a part of the work of preparing the charge. It is done by a simple crane and lift, and the charge is left suspended in front, and just above the retorts to be charged. I say retorts, as the scoop-substitute carries two charges of coal. It will be seen that by the use of these cranes there is an entire control over the charge and the height of the retort from the floor is not limited; also, there is absolutely a free course for the machine along the house, under the suspended charges. Thus the work is reduced to the lowest possible amount—the thrusting of the scoop into the retort. In lifting the scoop by hand, it is thrown on the mouthpiece. With the machine it slides along the cradle supporting it into the retort. The scoop thus being free to adapt itself, there can be no prejudicial action, to say the least, upon the retort. Those that you will see in action have already had a season's work. In drawing, the action is nearly the same as by hand. A rake is used, being pushed over the coke, worked into it, and the charge drawn. By hand there is no action upon the retort, the rake being free, so with the machine. By hand there is an elasticity in the operation of the tools—the scoop and rake—that is conducive to the preservation of the retorts; this elasticity, and also a freedom from shocks and violent strains, should be found in all arrangements of machinery for doing such work. In the machine you will see here, you will find, I hope, these qualities to a noticeable extent. Thirdly, the delivery of the coke. As done by hand, it is wheeled out into the yard and deposited; but other labour is required beyond this. A portion at least of the coke has to be shovelled into the barrows, and all of it has to be more or less trimmed and stacked; or, if with stage working, it has to be filled into waggons from the vault floor. Here, then, for machinery to do the whole of the work required, the coke must be removed from the house and lifted and stacked over a large portion of space—indeed, the entire coke yard. This I do by extending the coal-cranes through the sides of the house into the yard. On a previous occasion I alluded to the value of time in such work being very marked. Fixing the charging and drawing at a standard of a minute per mouthpiece, with a constant succession of work, every six or seven minutes gain or loss during the hour means a bed more or less per hour. It is, therefore, obvious that each operation should be timed to the others; that is to say, these operations should take a minute when worked at the quickest. With the arrangements here I have no doubt this will be regularly done. We can take the retorts at a minute per mouthpiece, and the charge of 2½ cwt. can be completed in about 12 seconds.

Mr. Warner's statement was received with much applause.

[In another part of to-day's issue will be found an illustrated description of the machinery.]

The members afterwards dined together at the Railway Hotel—the chair being occupied by Mr. W. Ford. In addition to those already named, the Mayor of Jarrow (Alderman Huntley) was present, and sat on the right of the Chairman.

After partaking of an excellent dinner,

The Chairman gave the usual loyal and patriotic toasts.

Mr. J. Pattinson, of Newcastle, proposed the health of the Mayor and Corporation of Jarrow, and in doing so referred to the important duties they had to perform in looking after the comfort and health of the inhabitants.

The Mayor of Jarrow responded, and remarked that it was very fitting that he, as connected with the Corporation of Jarrow, should take part in such a gathering, for while those present, as gas managers, were directing their attention to the improvement in the manufacture of a great essential in civilized life—namely, light—the body of which he was a member were, as a Corporation, giving their best attention to promoting the health of the people; and while much had already been done in this direction, much, there was no doubt, remained to be done. As a Corporation, they were endeavouring, by enforcing sanitary measures, to stem disease and reduce the rate of death.

Mr. Sellers, of York, said the next toast was one which he felt assured would be cordially received by every gentleman present. He had to ask them to drink to the health of the Directors of the South Shields Gas Company. They possessed many good qualities, first and foremost among which was their hospitality; for, as would be remembered by many present, about six weeks ago, when their Engineer, Mr. Warner, invited the gas managers to witness the working of his patent retort-charging apparatus, they most hospitably entertained them. In addition to the quality he had named, the Directors of the South Shields Gas Company were a very enterprising body of gentlemen, and not only so, but were also highly intelligent, and they had well displayed their intelligence by selecting Mr. Warner as their Chief Engineer and Officer. Their friend Mr. Warner had by his ability placed himself in the front in the gas world. They all admired his enthusiasm, his ability, and his industry, and he (Mr. Sellers) was sure the Directors of the South Shields Gas Company could not be served by a better officer than Mr. Warner. The Directors had shown their enterprise by endorsing and carrying out that gentleman's invention. It was very creditable to a small Company to have taken up the invention in the manner they had, and he was glad to have to acknowledge the enterprise, pluck, and courage of the Directors of the South Shields Gas Company. It had been said that the man who made two blades of grass to grow where only one grew before was a greater benefactor to humanity than he who won a battle; and he believed the next in importance to such a man was he who invented machinery to lessen human labour; and he could only hope that the invention of Mr. Warner would be crowned with success, and be generally adopted. If so, the name of Mr. Warner and the South Shields Gas Company would be handed down in the gas world for generations to come.

Mr. J. Henderson, of South Shields, in responding, referred at the outset to the remarks of Mr. Sellers in regard to the South Shields Gas Company being a small Company, and observed that they did not exactly look upon themselves as a small Company, though they were very much inclined to the opinion that they could not compare favourably in size with Newcastle and Sunderland, although they supplied not only two boroughs—South Shields and Jarrow—but also the Local Board of Hebburn, together with a large area in a rural district. He was sorry that the Chairman (Mr. R. Wallis) was not present with them that day; but in his absence he had, on behalf of himself and his colleagues, to return thanks for the cordial manner in which the toast had been received. He could assure them that the Directors were anxious to forward any improvement in the way of gas-making, so far as they possibly could; and the compliment they had paid Mr. Warner had not been undeserved, for by his energy, ability, and perseverance he had raised himself to a high position in the gas world. He (Mr. Henderson) then proposed "Success to the North of England Gas Managers Association." Although this was, he said, the first time he had had the pleasure of meeting the members of the Association, he hoped it would not be the last. He might remark that during the past four or five years they had had a great deal to contend with in the way—to give one instance—of the electric light; but he had no doubt that if these gentlemen, the gas engineers, would only still put their shoulders to the wheel, they would, so far as the supply of gas was concerned, be able to compete with it. In his opinion the electric light did not occupy the same position it did some months ago; and, although it might be useful for the lighting of public squares and large buildings, he did not think it would interfere with the lighting of shops and private dwellings. With reference to the invention of Mr. Warner, in addition to the saving of manual labour, it had also a humanizing effect, doing away with the most laborious work, and there was no doubt it would, in time, be generally adopted by gas companies. The great object, however, of the invention and of the inventor was to endeavour to make the manufacture of gas as cheap as it possibly could be made.

Mr. Cox, of Sunderland, in responding, referred to the usefulness of the Association.

Mr. Hepworth, of Carlisle, gave "The Health of Mr. W. J. Warner, the Engineer to the South Shields Gas Company." Mr. Warner, he said, by his ability, had fought his way into the front ranks of the gas engineering world, and had not only occupied the chair of this Association, but also that of the British Association of Gas Managers. Mr. Warner was well deserving of the position he had attained, and they admired him not only for the good qualities of his heart, but also for his inventive genius.

Mr. W. J. Warner, on rising to respond, was received with hearty applause. He said there was often a great distance between a person's desires and his attainments, and for himself he felt that his work ought to have been greater than it had been, and that he ought to have advanced the profession with which he was so closely identified somewhat more than he had done. He was afraid his friends saw in him many good qualities to which he could not lay claim. He, however, might say that

from his youth he had endeavoured to obtain a practical knowledge of his profession, and to extend that knowledge as far as in him lay; and he might remind them that when he was a young man there was scarcely a professional paper to be had. The JOURNAL OF GAS LIGHTING only appeared once a month, and was of limited size. Now a great change had taken place in this direction, and valuable papers were published in it with great frequency. It had been his desire to strike out some method of bringing gas people more closely together, and he consulted his friend, Mr. T. G. Barlow, the then Proprietor and Editor of the JOURNAL; and in a letter which he (Mr. Warner) wrote, suggestions were made regarding the formation of a Gas Managers Association. These were subsequently acted upon; and Associations were now found in almost every part, not only of this country, but also abroad. These Associations were the means of doing much good, and by mutual consultation the members were able to arrive at something beneficial. They had been enabled to secure a considerable amount of economy in the carrying on of their works, especially in regard to unaccounted-for gas; for what was formerly 30 per cent. had now come down to 5, 6, 7, 8, or at most 10 per cent. This was one of the causes of their success. He thanked them sincerely for the enthusiasm with which they had received the toast.

The MAYOR of JARROW gave "The Health of the President of the Association," which was received with applause.

The PRESIDENT acknowledged the compliment, and in referring to the invention of Mr. Warner in the way of saving labour, said he hoped that gentleman's inventive genius would be further exerted so that additional advancement would be made in this direction. By so doing it would tend to still further reduce the price of gas, and to extend the advantages of light into every dwelling. The President then proposed "The Health of Mr. Hardie, the Honorary Secretary," who had been most indefatigable in his efforts on behalf of the Association.

Mr. HARDIE responded, and said it had always been a pleasure to him to do what he could to help on the Association. Speaking of the meeting held in Newcastle, he said it was gratifying to note how cordially they were aided by the local Companies, as well as by many gentlemen connected with the gas industry in the district.

Mr. HENDERSON then gave the health of Mr. John Pattinson, Analytical Chemist, who was well known in the North of England, not only as a scientific gentleman, but more particularly as regarded chemistry. Mr. Pattinson was connected with every Gas Company on Tyneside, and although he (Mr. Henderson) did not know what his friend Mr. Warner would say, he could only remark that the monthly visits of Mr. Pattinson were a very great relief to the Directors.

Mr. PATTINSON, in responding, said he had invariably found both managers and directors of gas companies extremely anxious to give the very best article they possibly could. With respect to sulphur, with which they had to contend, he thought he might say that it was almost conquered. They had had recently some experience in this direction at South Shields, where the sulphur suddenly rose to a very alarming extent; but he was very glad it did occur at South Shields, because he knew they had there a very excellent Engineer, and the result was that, through Mr. Warner's efforts, it was brought down far below the standard allowed by Act of Parliament. Mr. Warner not only knew how it was done, but could do it again, and also teach others to do a similar thing. With regard to the illuminating power of the gas, it had always been their desire to keep it up, and very rarely indeed had he to report that the gas was below the standard required by the Act of Parliament.

Other toasts followed, and the proceedings concluded.

WEST OF SCOTLAND ASSOCIATION OF GAS MANAGERS.

EIGHTH ANNUAL MEETING.

(FROM OUR OWN CORRESPONDENT.)

On Thursday last, the Eighth Annual General Meeting of the West of Scotland Association of Gas Managers was held at Hamilton, under the presidency of Mr. Robert Mitchell, of the Coatbridge Gas-Works. As usual, a full report of the proceedings will appear in the JOURNAL; but, in the meantime, I hasten to give a summary sketch of what took place.

The meeting was held in the Town Hall, the local arrangements having been made by Mr. John Johnstone, Manager at the Hamilton Corporation Gas-Works. There was a very large attendance of members; and amongst the gentlemen present there were Mr. Robb, of Haddington, President of the North British Association of Gas Managers; representatives both of the extraordinary and honorary members of the Association; as also of the Gas Commission of Hamilton, including Bailie Cassells, the Convener of the Gas Committee, and the much-esteemed Chief Magistrate, Provost Forrest. The President having taken the chair, the Secretary (Mr. S. Dalziel, of Kilmarnock) read the minutes of the Committee of Management for the past half year, which served as a kind of official report. These were duly confirmed, and then the office-bearers for the ensuing year were elected. Mr. Robert S. Carlow, a former Secretary of the Association, was advanced from the position of Vice-President to succeed Mr. Mitchell in the presidential chair; Mr. Dalziel was elected Vice-President; Mr. Johnstone, of Hamilton, was appointed Secretary; Mr. William Smith, of Helensburgh, was re-appointed Treasurer; and a number of other gentlemen were elected to act with them as the Executive Committee. At this stage Mr. J. M'Gilchrist, of the Dumbarton Gas-Works, brought forward his motion asking that the Committee should be instructed to revise the rules of the Association, more especially with reference to the mode of electing the Committee, and suggesting that the system which prevails in the two leading Associations of Gas Managers—the British and North British—should be adopted. The motion was seconded, briefly discussed, and unanimously adopted. Next in order, the Auditors were elected; a very encouraging financial statement from the Treasurer was submitted and agreed to; and five new members were elected. These items of the more formal business being got through,

The President proceeded to deliver his valedictory address. He pointed out that since the electric "scare" fell upon the country about two years ago, gas engineers had been more than ever diligent in research, in order to hit upon schemes designed to cheapen the price of gas to the consumer. That "scare" had exercised a material effect in bringing about various improvements, and in his opinion the time had been reached when some of the old systems of gas-making would be revolutionized. If in future gas was to be made cheaper to the consumers, a radical improvement must be wrought in the retort-house; indeed, that was the place in which changes, if they were to be of any avail, must be carried out. Mr. Mitchell subsequently dwelt at some length upon the most approved methods of building a retort-bench, the kind of retorts used, the setting of the retorts, the extent to which coal should be broken before being charged into them, the modes of heating the retorts, and more especially the application of gas-furnaces on the Siemens heat-regenerative system, and on the substitution of mechanical stokers for hand labour. On the last-mentioned topic he briefly noticed what he had seen at Manchester, where both the Foulis and West systems of stoking by machinery were in operation. The address contained many valuable practical hints, and was received with much attention and approbation, and at its close Mr. Mitchell was awarded a very hearty vote of thanks.

A long and animated discussion then took place on the proposed amalgamation of the West of Scotland and the North British Associations of Gas Managers. The speakers were Mr. James M'Gilchrist, Mr. D. M. Nelson, Mr. Niven, Mr. Dalziel, Mr. Adamson (Airdrie Iron-Works), Mr. Thomas Wilson (Saltcoats), Mr. Renfrew (Langbank), and the Chairman. Several proposals were submitted, but there seemed to be a general feeling that the West of Scotland Association should not sink its separate existence. The Secretary stated what had been done in the negotiations that had taken place between the representatives of the two Associations, and in the course of the discussion it was mentioned that the proposal for an amalgamation had arisen not with the West of Scotland but with the North British Association. It was eventually resolved by a large majority to let the matter drop, as there was no definite scheme contained in the overtures for amalgamation.

The first paper submitted to the meeting was one by Mr. David C. Niven, of the Dunoon Gas-Works, on "The elaborate and tedious Thermometric and Barometric Calculations relative to Coal Gas simplified." Mr. Niven began by showing the necessity for gases being reduced to like conditions, that there should be some definite unit as a standard for comparison, and that temperature and pressure were all-important factors in such conditions, and he showed that, in their construction, the thermometer and barometer implied physical laws, which had been determined by exact experiments, and could therefore be applied through definite calculation. He subsequently passed in critical review the formulæ of Clegg, Wright, and others, together with the common processes of calculation for corrections of temperature and pressure, as quoted from the usual text-books. Mr. Niven gave numerous examples illustrative of his mode of carrying out the necessary calculations in regard to coal gas under the varying conditions of temperature and pressure, and they were so simple, easy, and expeditious as to indicate very evidently that he had made a decided advance over the usual tedious processes. A feeling was strongly expressed, both during the discussion upon the paper and afterwards, that Mr. Niven would confer a favour upon the members of the Association if he were to give them the benefit of his studies by preparing tables for use in photometrical operations. He was heartily thanked for his paper.

At this stage the President announced an adjournment, as the Provost of Hamilton and the Gas Committee of the Town Council had invited the members to visit and inspect the gas-works, which had lately been very much extended and improved. On arriving at the works, the members were shown over the premises by the Convener of the Gas Committee and by the Manager, and were greatly interested in what they saw. When the inspection was completed, the visitors were served with a very welcome refreshment, and they cheerfully joined the President in wishing success to the Hamilton Gas-Works and the Gas Committee. Bailie Cassells replied to the toast in an excellent little speech. Business was shortly afterwards resumed at the Town Hall.

Mr. John Mayer, F.C.S., of Glasgow, read a paper in which he gave a comprehensive statement regarding Painter's Hydrostatic Joint for Gas and Water Mains. He remarked that he could not lay claim to be regarded as a "practical" man, but as the invention had appeared to him to be one of much scientific value, and likely to be attended in use with marked advantage, both economically and otherwise, he had obtained all the information that was available regarding it, and with the permission of the executive officers of the Association he had undertaken to lay it before the members. The paper was illustrated by diagrams, and by a section of a cast-iron pipe that had actually been caulked with lead by Painter's hydrostatic method. Much interest was excited by the paper, and the author received the best thanks of the meeting for bringing the subject forward. In the course of the discussion which followed, a fear was expressed that the production of the hydrostatic joint would be as expensive as the operation of making a caulked lead joint in the ordinary way; and several members were led to speak of the cement which was in use in England for jointing gas-mains, and which had the property of expanding as it "set." One speaker urged that the cement would not be gas-tight, in confirmation of which Mr. Mayer stated that the plaster of Paris, having "set," was well known to be permeable to gases, and that it was used to demonstrate the law of osmosis and the diffusion of gases through porous septa, as was also unglazed earthenware.

Mr. William Brodie, of Paisley, subsequently read a most interesting and highly practical paper on "Gasholder Construction," in the course of which he gave many useful hints on planning gasholders of different sizes, and in using the same; and as they were the result of professional experience gained over a period of fully 30 years, he certainly placed the members under a deep debt of gratitude to him. Owing to want of time very little discussion took place on the subject of the paper; but the President conveyed to the author an expression of the heartiest thanks of the members for the instruction which they had received from him.

It had been intended by Mr. L. Monk, of Lanark, to submit a paper to the meeting on "An Improved Washer suitable for Scrubbing and Washing in Small Gas-Works;" but as one similar to that which Mr. Monk has in use is being put in operation at another works, he preferred to defer his remarks on the subject till the next meeting of the Association.

The last item on the programme of business was a report from a Committee on Mr. G. R. Hislop's system of re-burning spent gas lime. This, which was submitted by the President, was a detailed statement embodying many important data and figures; it was resolved to hold over the consideration of it until next meeting, so that the members could, in the interim, have an opportunity of studying it in print.

After a little discussion it was agreed that the next half-yearly meeting, to take place in September, should be held at Port Glasgow. Some formal votes of thanks were then passed; a very hearty one, on the motion of Mr. D. M. Nelson, being given to Mr. Mitchell, the retiring President, to which he suitably replied; and one to the Secretary, on the motion of Mr. Samuel Stewart.

The meeting then broke up, but a large number of the members subsequently sat down to dinner in the Commercial Hotel. Mr. Mitchell occupied the chair, and Mr. M'Gilchrist and Mr. Carlow were the croupiers. Amongst the guests present there were Bailie Cassells and several members of the Gas Committee, Mr. Robb, of Haddington, and other gentlemen. Various appropriate toasts were proposed and responded to, that of "Kindred Associations" being given by Mr. D. M. Nelson, and responded to by Mr. Robb, in his capacity of President-Elect of the North British Association of Gas Managers.

Alike in respect of attendance and business done, the eighth annual meeting of the West of Scotland Association was a decided success.

BRIDGWATER CORPORATION WATER SUPPLY.—On Monday last week Mr. T. Hawksley, C.E., the Engineer employed by the Bridgwater Corporation in connection with their new water-works, visited the works with the view of giving a final certificate as to their completion, at a cost which, it is believed, will reach close upon £40,000, that gentleman's estimate before the House of Commons Committee in 1877 being £32,000. The works were opened and the first supply of water was laid on in the borough about four months since, and already a large number of the inhabitants have availed themselves of it.

METROPOLIS WATER SUPPLY.

Metropolitan Board of Works.

At the Meeting of the Board on Friday last—Sir J. M. Hogg, M.P., in the chair—the adjourned debate on Mr. Selway's motion in reference to the Water Supply of the Metropolis was resumed. The motion was as follows:—"That it be referred to the Works and General Purposes Committee to consider and report as to the advisability of this Board applying to Parliament for an Act to improve the Water Supply of the Metropolis, either by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon." To this Mr. Munro had, since the previous meeting of the Board, given notice to move the following amendment:—"That the question of the supply of water to the Metropolis be referred to the Works and General Purposes Committee for consideration and report, with power to confer with Her Majesty's Government thereon."

Mr. Turner, in supporting the motion, said he considered that no question of greater or of even equal importance had been brought before the Board since its formation than that of the Water Supply of the Metropolis. It had received as much attention outside as inside the Board, and many of those who had been engaged in the sanitary arrangements of their various parishes had had its importance brought before them in a way that compelled them to give it their earnest consideration. In inspecting the various houses of the parish which he represented, he found that the condition of the water-butts in the lower class of houses, and of the cisterns in some houses of the better class, was such as to require prompt and immediate attention. It would be in the recollection of some gentlemen connected with the Board that application was made for the Board to put into operation the provisions of the Act of 1871, by which they had the power to compel the New River Company, and indeed any of the Companies, to give a constant supply of water when required. He regretted that when the Board had the authority placed in their hands for securing a constant supply, they allowed year after year to pass without taking any action in the matter. The parish which he represented sent a memorial to the Board asking that they would compel the New River Company to grant, for certain districts in the parish, a constant supply. After five months delay the Board came to the conclusion, by 23 votes to 5, not to comply with that request, and the Vestry then applied to the Local Government Board. He referred to this because he conceived that it would have been far better if the Board had taken action in the matter, and by a gradual process secured a constant supply of water for the inhabitants of London. One of the most formidable difficulties now connected with the subject arose from the immense responsibility of work which the management of the water supply would entail upon the Board. Even at present there was more work thrown upon their shoulders than they could well accomplish. But was this a reason why they should cast off their responsibility in relation to the water supply? He thought it was not. On the other hand, it might be regarded as a stimulus to them to have the constitution of the Board itself altered, and its basis broadened, so that the work might be distributed with something like equality. Representing as they did the ratepayers of London, there was no body in existence at the present time more entitled to the confidence of the inhabitants, or to whom the control of the water supply could be more properly given. That there was a pressing need for a change, everybody was prepared to admit. He supported the motion because it did not commit the Board, in the slightest possible degree, to any particular course of action. They would be able to consider first whether it was desirable that the water undertakings should be purchased, and next who should be the purchaser. Ought the Board, as at present constituted, to have charge of the supply of the Metropolis with water? or should the Board seek, through the Government, a broader basis and an increase of numbers before they did anything to get the water supply? In the hope that the matter would receive a satisfactory solution, he should support the motion.

Mr. Munro said his opinion was as strong as possible upon the question of the impurity of the water as at present distributed in the Metropolis, and the excessive cost and inadequacy of the supply; but he contended that two years ago, by introducing one Bill for the purchase of the water-works, and another for a continual supply, the Board did all that Mr. Selway now asked them to do. What was the result of those two Bills? He wished to ask the Chairman whether, when he introduced the Indemnity Bill in the House of Commons, he personally gave any pledge that the Board should take no further steps.

The Chairman said he could not possibly get the Bill through under any other conditions, and he gave an undertaking not to bring in any Bill affecting the character of the ordinary water supply without the consent of Government.

Mr. Munro said he hoped under these circumstances Mr. Selway would accept the amendment as the only safe course that the Board could adopt in order to be consistent.

Mr. Selway said he was perfectly willing to amend his motion in these terms—to strike out the words after "report," and let it read in this way: "That it be referred to the Works and General Purposes Committee to consider and report upon the necessity of improving the Water Supply of the Metropolis, either by amending and regulating the powers of the existing Water Companies, by consolidating their undertakings, by providing an additional supply of pure water, or by any other means the Committee may deem desirable, with authority to confer with Her Majesty's Government thereon."

Mr. Munro said he would consent to that alteration.

Mr. Jones suggested that in addition to the "necessity" the "means" should be taken into consideration.

Mr. Selway accepted the suggestion. The motion would then read: "That it be referred to the Works and General Purposes Committee to consider and report upon the necessity and means of improving the water supply," &c.

The alteration having been agreed to,

The Chairman intimated that he should treat it as a fresh motion.

Mr. Cook seconded the amended resolution.

Mr. Munro supported the motion. He said if the Board had confined itself to the Purchase Bill two years ago, much more would have been done by this time than had been yet accomplished. He was not surprised at Mr. Selway bringing this motion forward when he found there were certain gentlemen in the Metropolis who met together regularly, and constituted themselves a body representing the various Vestries and District Boards, taking upon themselves the office of being the exponents of the views of the inhabitants on the water question. The Metropolitan Board were the only constituted authority to deal with questions affecting the interests of the whole Metropolis, and he hoped the present Government would listen to the arguments of the Board in favour of giving them the control of the water supply. He trusted that the new Government would not deal with the question as the last Government did—namely, by appointing nominees. He ventured to think that the members of the Board knew more about the requirements of their various districts than any other body of gentlemen of the same number in the Metropolis. If the Board were increased in numbers it would be able to discharge the duty of controlling the water supply for the benefit of the ratepayers.

Mr. Fowler said this question had so long agitated the public mind, that some alteration must be effected. He was strongly in favour of the resolution, because he did not think it should be left to parties outside the Board to consider upon what terms the supply should be taken over, or what should be done in order to meet the necessities which everybody agreed existed. He protested against any self-appointed body of gentlemen setting themselves up as representing the whole Metropolis. The parish with which he was connected, as well as a number of others, was not represented in that body, and therefore any conclusions which they arrived at should be regarded as of no effet. At a meeting recently held, the Chairman moved a resolution upon the lines of Mr. Cross's Bill; but this was negatived by a small majority, and he understood that it was the intention of those gentlemen to hold another meeting, and endeavour to carry forward some scheme to improve the Water Supply of the Metropolis. He did not think his friend had been wise in talking about the constitution of the Board. What he wanted to see done, and what the resolution aimed at, was that the Board should go thoroughly into the whole question, master all the details, propose such a scheme as would be equitable between the ratepayers and the Companies, and then to enforce it with all the authority they could bring to bear upon the Government. According to the statement in the Water Companies accounts for the year 1878, their total capital outlay was about £12,000,000. Now the initial question to be decided was whether this property was a monopoly or not. The Select Committee appointed to consider the question reported that when Parliament gave the Companies the power to supply the Metropolis with water they did not give them a monopoly, but left the supply open for competition. That, of course, must affect the question of what was to be done supposing the water-works were to be bought up either by Government or by the Board. Yet now it had been proposed to give for that amount of £12,000,000 upwards of £35,000,000 in the year 1893. Instead of taking the amount of money which the Companies had laid out, the valuator took the income, capitalized it at 3½ per cent., and gave the Companies a sum of £22,315,000 in water stock. But they did not stop there. The Companies had unearned increments, and they spread them over the 12 years, making £9,280,000, and, in addition to this, converted into stock the loans of the several Companies—£3,600,000—making a total payment in 1893 of a sum of £35,185,000 for the income of £773,000. This was paying very largely for the property. It was known that a New supply could be obtained from Wales for £20,000,000, and there was also abundant water in the chalk underneath London. If the scheme were agreed to, what would be the annual sum that the ratepayers would have to pay? They would have to pay 1-80th of the £35,000,000 on the first year, or £400,000 in addition to 3½ per cent., or £1,209,700, and working expenses £600,000, making £2,247,200 a year. A Bill by which the price could be regulated and conditions placed upon the Companies with respect to purity and extending the constant supply system might be better in such a case than purchasing the undertakings, because in the latter case an enormous additional sum would have to be expended in perfecting and purifying the present supply. Everybody agreed that the water-rates were excessive as well as unequal; but what chance was there of getting the rates any lower? The occupiers of warehouses in the City paid a very large sum for their water in proportion to that which was paid by the middle classes. On the other hand, if the supply were given by meter, the consequence would be that City men would be relieved, while the lower and middle classes would have to pay a much larger amount for their water. This showed how difficult it was to express any opinion until the whole subject was carefully considered. He did not say that a Regulation Bill would be the best thing, but it was a question which the Committee should take into their serious consideration. It was the duty of the Board, as being the only body which represented the ratepayers of the Metropolis, to inquire into the matter, and give it most earnest attention, so that they might be able to lay down proper lines for providing a better, purer, and more extensive water supply, at the same time having due regard to the pockets of the ratepayors, and not entailing on those who came after them a burden which they could not bear.

Mr. Tolhurst proposed as an amendment that the consideration of the matter be deferred for six months. If the member for Newington had introduced an abstract motion for the purpose of ventilating the question, and showing the ratepayers that the Board were still fully alive to the importance of the question, he would have supported him; but he could not vote for a practical resolution that the General Purposes Committee should set to work at once for the purpose of submitting a measure to Parliament. The resolution which had been put on the paper was almost similar to that which was brought forward three years ago. The General Purposes Committee then went into the whole matter, and brought forward a scheme which took the form of two Bills—one for a new supply, and the other for the purchase of the existing water-works. The resolution authorizing the Committee to propound that scheme wound up with words similar to those at the end of the present resolution—"And confer with Her Majesty's Government thereon." It was never carried out in its entirety. Her Majesty's Government were not conferred with. The new Supply Bill was referred to a Committee, and the Purchase Bill never reached its second reading. The whole question was a second time referred to the consideration of the Works Committee, and it was resolved to bring forward a single Bill for the purchase only. While all these proceedings were going on, how did the public regard the Board? The Board brought the measure forward for the benefit of the public. An Association was formed in the Southwark and Vauxhall Water Company's district, and a meeting on the water question was held at the Bridge House Hotel, but not a single resolution was passed asking the Board to come forward and assist the ratepayers. He was entirely in favour of obtaining a pure supply of water, and of reducing the rates; but the Board must consider what took place in Parliament last August. Mr. Cross redeemed the pledge he then gave by bringing forward a Purchase Bill, but that Bill met with very little favour throughout the Metropolis.

Mr. Selway: With a howl of indignation.

Mr. Tolhurst said that was so, but he was not quite sure that the merits of the Bill were ever fairly discussed. His friend had alluded to the action of what he termed a self-constituted body; but as far as he (Mr. Tolhurst) knew, that body represented all the Vestries and District Boards in the Metropolis. At all events the Vestries and District Boards had been invited to send representatives there, and the gentlemen constituting it knew what were the feelings of their constituents. They had not, however, passed a single resolution asking the Metropolitan Board to take over the Water Supply of the Metropolis. This was an important fact to be considered—that such a body did not request the Board to take the initiative. According to the daily papers there was another public body—the National Chamber for the Protection of the Interests of the Ratepayers of the Metropolis—which had passed a resolution to go direct to the present Prime Minister, and ask him to deal with the question. Ought not the matter to be left in the hands of the Government? The Board had already taken action and failed. They had, at a very great expense, endeavoured to assist the ratepayers, and the ratepayers had never even thanked them. The burden of the song now was that the constitu-

tion of the Board must be altered, the water supply being made a lever to induce the Government to consider the question of reforming the Board. He was quite willing to go to some expense if thereby the ratepayers could get a purer and cheaper supply of water; but he thought the Board ought not to consider the question, even in committee, until the present Government had had an opportunity of explaining their views.

Mr. REDDISH seconded the amendment. He said that some years ago the charge for water was so much on every room in a house, and the object of passing the Assessment Act was to a great extent to relieve the lower class of ratepayers who could least afford to pay, and to throw the expense very much on those who could best afford to pay. That was the reason why gentlemen in the City had to pay a large sum without consuming very much water. He believed that the body which had been referred to as self-constituted, represented the ratepayers of the Metropolis as much as the Metropolitan Board did. His Vestry was invited to send a deputation, and they did so. The Board had not been asked to interfere. It had been suggested that the Board should be enlarged, but in his opinion the only effect of enlargement would be to bring in a greater number of talkers. The present Government had only just come into power, and the Home Secretary had not had an opportunity of giving attention to the question. Another point for consideration was whether the municipal affairs of the Metropolis should be divided among a number of petty bodies, or whether the Vestries, the District Boards, and the City of London should not be under one government. While the City was governed by one body, and the other places by another body, the interests must clash. He, therefore, supported the amendment which had been proposed, and he thought the Board would act discreetly in having nothing to do with the water question at present. So far as his knowledge of the Water Companies went, they had not availed themselves of the power they had, under the new Assessment Act, to increase their charges considerably. With regard to the quality of the water, he thought the public could very well endure a little turbidity occasioned by the floods. He spent some years of his life near London Bridge, when the only water he could get was that pumped up near to the bridge, and yet he was now alive at the age of eighty-one. He believed no man could tell what the cost of purchasing the water-works undertakings would be. Everything had been advancing in price since the New River Company was created, and it must not be forgotten that the Shareholders in some of the Companies invested their money a great number of years ago, and received no interest for a considerable time.

Mr. RICHARDSON thought that the Board were indebted to Mr. Selway for having proposed the resolution. He had felt considerable difficulty in voting for it as it was at first brought forward, because it almost seemed to pledge the Board to go to Parliament, and he wished the Board to be left as free as possible. He was not aware at the time that the Chairman had given any pledge that he would not in future present any Water Bill to Parliament without the consent of the Government. It must be clear to every member of the Board that it would be perfectly useless for them to go for a large measure of water supply without such consent. Mr. Tolhurst's address seemed to him to set the whole principles of local self-government at defiance. If there was one point more than another which he objected to in the Bill of the late Government, it was that it ignored the principles of local self-government. It was a centralization from beginning to end; and he thought the Board ought, in every possible way, to show determined opposition to it. The figures in the Bill could not be judged of except by statements of accounts which were not at the present time before the public. The total dividends of the Water Companies were not known later than 1878: but at that time they amounted to £699,270. Under the Bill the first year's dividend to be paid by the ratepayers would be £773,454, or an increase in the net income of the Water Companies of no less than £74,000. Then it should be remembered the arrangement proposed by the Bill did not include compensation to officers, and though it secured the Companies maximum dividends, it allowed the New River Company to retain all their freehold property except that which was immediately connected with the water supply. Were the ratepayers satisfied with the water supply? His friend who last spoke seemed to like the supply, but very few persons would be found to sympathize with him. They would prefer water without any sewage in it. The Bill of the late Government had proceeded on the principle that the Water Companies were all perfect concerns, whereas the whole Metropolis was of opinion that they were imperfect. The whole Bill was therefore inconsistent. Though the supply was confessedly imperfect, the Companies were to receive as much money as if it were absolutely perfect. Several millions ought to be struck off to represent the imperfection. Mr. Tolhurst's amendment was only a pure negative. The object which the Board ought to have in view was to press on the Government the necessity of dealing with this question at once, and on very different terms from those in the late Home Secretary's Bill. If the Board were authorized to purchase the water-works at a proper price, the districts outside the Metropolis might be supplied on terms not higher than under the existing rates. It was proposed in Sir R. Cross's Bill to make the expense a charge upon the metropolitan consolidated rate. Could anything be more absurd? The consolidated rate might be only on one-third of the area, and yet that smaller area was to be a security for the whole. The Metropolitan Consolidated Stock was an irredeemable stock, and yet there was a clause in the Bill requiring that after ten years there should be a sinking-fund. What on earth was to be done with the sinking-fund if the stock was irredeemable? He thought the Bill was as injurious to the ratepayers as it possibly could be. One principle which he would like to see established was that the representative body of the Metropolis was the only body that could deal with the water supply. No other body could do it properly. If that principle were enforced, he believed the Government would assent to it. The later the solution of the difficulty was left, the worse it would be for the ratepayers, and that was another argument against the amendment.

Mr. ELT said he had noticed that this agitation was got up, not by the general body of the ratepayers, but by journalists, scientific men, and experts. There had been no association of thousands of consumers complaining of the water. Chemists gave frightful accounts of the water, but neither by sight, smell, nor taste could the impurities be discovered. He was not much of a water drinker, but he had no fault whatever to find with the quality of that which was supplied to him by the New River Company. He had spoken to persons who had been accustomed to use the Kent Company's water, and they assured him they preferred that which was supplied to other districts, because their water was so hard. The great towns in which the Municipalities had the control of the water did not get a better or a cheaper supply than the inhabitants of the Metropolis. Glasgow had had a new water supply from Loch Katrine. About three years ago he was talking to some residents in Glasgow, and they complained of the water, and also of the price they had to pay for it—13d. in the pound upon the rental. He had looked into the charges at Birmingham, Manchester, and Liverpool, and there the ratepayers had to pay more than those in London did. If the system pursued in the Metropolis were changed, he did not think the water would be one penny cheaper—on the contrary, he thought the price would be increased; and he very much doubted if purer water would be supplied. He supposed a constant supply would be gradually obtained throughout London by those who chose to have it. His experience of the Board was that as it was at present constituted it was the worst body that could possibly be conceived for controlling the water supply. They had, at present, quite enough to do. They were an unpaid body. Their work now was double what it was when he first of all had a seat at the Board, and the management of the water supply for the 4 million inhabitants of the Metropolis, and another million outside, would be quite work enough for a separate body. He should, however, like to see that separate body a representative one, and not consisting of nominees. He did not see that any harm could be done by referring the matter to the Works and General Purposes Committee.

Mr. FELL said he was rather amused at the conclusion to which the last speaker had arrived. He had been speaking entirely in opposition to the motion, and yet he meant to support it. There could be no question that public opinion was fully settled on the matter, and a great alteration must take place with reference to the future water supply of London. He did not think the late Government imagined their Water Bill would pass. In a happy (or unhappy) moment, Mr. Cross gave a promise that he would take the question up, and he carried out his pledge. He (Mr. Fell) thought the Board had neglected to place themselves in communication with the metropolitan members of Parliament. They had been to a very great extent ignored by the late Government, and therefore could not be surprised at what had happened. He thought if the Board thoroughly considered all the difficulties which surrounded the question, gave the Government the benefit of their advice, and asked them to do something to bring it to a satisfactory issue, there could be no doubt the Government would do so. He did not think it was likely for a moment that the present Government would establish a third governing body in the Metropolis. The system on which the late Bill was drawn betrayed all the principles of self-government, and he maintained that it was the duty of the Board to do all they possibly could to further the principle of local self-government. By adopting Mr. Selway's motion they would do so. Under the present constitution of the Board, the power had a tendency to dwindle into a few hands, because while some gentlemen could, others could not give their whole time to the business of the Board. He had great pleasure in supporting the motion.

Mr. LLOYD said if the whole of the Metropolis were polled, the expression of opinion would be that the Metropolitan Board was certainly the proper body to have the control of the water supply, and that the terms proposed by the Bill of the late Government were such as never could be accepted. Under these circumstances, what was the bounden duty of the Board? To go to the Government and say, "We have considered the matter fully, and we are prepared to act in the interest of every inhabitant of the Metropolis." From the time when the Metropolitan Board took over the control of the water supply, it would deal with it as a necessary of life, without any idea of making profit. On the other hand, the Water Companies must make profit, and must pay their Directors. When he heard the member for Islington (Mr. Elt) say that the Board were not competent to undertake the task, he would ask him whether the Board had ever failed in performing any duty that had been cast upon them. From the past they had a right to argue for the future; and as the Board had done well with regard to everything else, so would they do well with regard to water. The Companies had maintained that they had an indisputable right to supply the whole Metropolis, and nobody could interfere with them. He wondered whether they had ever considered the 116th clause of the Metropolis Local Management Act, which said, "Every Vestry and District Board shall have full power and authority to cause all or any of the streets in their parish or district to be watered as often as they think fit, and also to cause any wells to be dug and sunk in such public places as they think proper, and also to erect and fix any pumps in any public place for the gratuitous supply of water to the inhabitants of the parish or district." Attempts had hitherto been unsuccessful to get at the great supply of water underneath London; but the time might at any moment arrive when this supply would be reached, and then what would become of the rights of the Water Companies? What terms would they be inclined to agree to when any Vestry or the Metropolitan Board might sink as many wells as they pleased, and charge the expense upon the district? Why, the Companies would then be in the hands of the Vestries and District Boards. The Companies, therefore, had nothing like a perpetual right. Under these circumstances it might have been imagined that the Companies would have been only too delighted to come to terms. It had been said that the Board had applied to the Government and not obtained an answer; but this was not true. To the best of his recollection, one of the answers received was, "We do no think the Metropolitan Board of Works is the proper authority to have the water supply of the whole Metropolis, because the Companies supply districts outside the Metropolis." But when the same Government brought in a Bill, how did they get over this tremendous difficulty? They proposed a Board consisting of three paid Government nominees to do the work which the Metropolitan Board were at first thought incapable of doing. Then it had been said that the inhabitants did not complain of the present supply; but the truth was that the complaints were endless, and if it were not known that every representative on the Board desired to bring the question to an end, they would be swarmed with complaints. It was the bounden duty of the Board to persevere to the very last in their efforts to supply the inhabitants of the Metropolis with the best quality of water, and he sincerely hoped that the motion would be carried.

Mr. FREEMAN said if he understood the junior member for Islington, the principle he laid down was that the Board should not undertake any duty which was not forced upon them; but he (Mr. Freeman) ventured to think that their business was to attend to the interests of the inhabitants of the Metropolis, and be willing and anxious to act whenever they could see an opportunity of doing good. He thought it had been settled on all hands that the Water Supply of London ought no longer to be conducted on commercial principles, that profit out of it ought to cease, and that henceforward the great object should be to give an unlimited supply of pure water at the cheapest possible rate. In the Bill brought in by the late Home Secretary, a fictitious value had been put upon the property of the Water Companies. Every possible contingency in the direction of increased dividends had been considered, and the ratepayers had been charged with it; but everything that might tell against the Companies had been left out. He ventured to think that a Bill providing for greater disadvantage to the ratepayers of the Metropolis and more unjust benefit to the Shareholders in the London Water Companies was never conceived. The main feature of the Bill was patronage, ignoring local self-government, and it was a measure which the Metropolitan Board as a representative body, could not for one moment sanction. However, Sir R. Cross was gone, and he (Mr. Freeman) hoped that the present Government would see that some representative body of the Metropolis was established strong enough, and on a basis broad enough, to undertake the management of the water supply and everything else that properly belonged to a municipality. The duty of the Board was to carry Mr. Selway's motion, to consider calmly what was needful to be done and the means for doing it, and then communicate with the Government, and place before them what they considered necessary for the Metropolis,

seeking their co-operation, and asking them to bring in a Bill. He had no notion about considering the consequences and results. Their duty was before them; let them perform that duty, and leave the consequences and results to take care of themselves. He quite agreed that it would be folly for the Board to attempt to grapple with the great and complicated power that there was opposed to the Board in the House of Commons. If the Board would come to some arrangement with the Government, so much the better; but if they could not, they would, at all events, do their duty in making the attempt, and they must bide their time.

Mr. Cooke hoped the Board would not agree to any delay, because every year that the settlement of this question was postponed would increase the cost to the ratepayers of the Metropolis. While Mr. Elt was speaking, he could not help thinking of the pumps in the City and in the East-end of London, which, 25 years ago, used to be sought after by the inhabitants because the water obtained from them was so clear and sparkling; but when it was analyzed it was found that the people were actually drinking the vestiges of the previous generation, which had drained into the wells from neighbouring churchyards. The pumps were then closed. People never asked to have them closed; it was the "journalists" and the "scientists" who did it for the benefit of the people. If they waited until all the population of London were sufficiently educated by the School Board to know that it was not wholesome to drink the sewage of Oxford, Windsor, Luton, Hertford, and Ware, they would have to wait a long time. It might be said that the people of London did not drink the sewage of the up-river towns; but would any person who said so tell him what became of the sewage of those towns? With regard to what ought *not* to be done, they no doubt were all perfectly agreed, and that was that Sir R. Cross's Bill ought not to be proceeded with. He could very readily believe that every one who happened to be the fortunate possessor of a share in the New River Company wished the Bill to be carried; but it would not be to the interests of the consumers or the ratepayers. Then it would be asked, Why should the Board deal with this question? Because no other public body knew so much about it. The Board had in their archives all the facts available both as to the quality of the present supply of water and the prospects of getting other supplies. But the Board had done more than merely obtain all those facts. After a great deal of trouble and expense they had prepared two Bills, and he ventured to say that those Bills represented the best knowledge upon the question which was anywhere available. Why were those Bills forgotten? Because the late Government said they would have nothing to do with them. He really thought that the wisest plan would be to submit those Bills to the present Government, and say, "We took a great deal of pains and went to considerable expense to prepare them. We thought they were very good Bills, but nobody would look at them. Will you look at them, and say what you think about them?" A great many people had theories about bringing water from the mountains of Wales; but the Metropolitan Board had a definite and clear plan, which he thought should be submitted to the Government.

Mr. Jones said the Chairman had told them that he was obliged to commit himself to the promise that he would not again bring forward any measure relating to the Water Supply of the Metropolis, except with the previous consent of the Government. The Indemnity Act of last year had disqualified the Board from spending a single shilling upon this question, for it declared that they had exceeded their powers in endeavouring to pass the two former Bills through Parliament; but if there was one object more than another which a municipal authority should aim at, it was to provide pure air and pure water for the population. It had been said that he (Mr. Jones) was not opposed to monopolies, and that as the Water Companies were private enterprises he would not interfere with them. The Municipality of Paris regulated the water supply of that city, and artesian wells were being sunk which promised to give an abundant supply. It might be that the same thing could be done in London. Then the question arose, had the Board a right to interfere with private enterprise? They had that right if the private enterprise charged higher prices than the thing could be done for by other means; and it was an offence against their judgment to permit private Companies to supply a necessary of life, and charge 10 per cent. for it, when the Board would be able to borrow money at 3½ per cent. and perform the same work. The Royal Commission on Water Supply determined that the upper reaches of the Thames would supply an abundant quantity of pure water, equal to 150 million gallons per day, and those upper reaches might be preserved from contamination by the populations. Mr. Prestwich also had pointed out that the subterranean waters in those upper reaches would afford an abundant supply, even if the superficial supply were untouched. If the Board, therefore, could bring into London an abundant supply of good water at 3½ per cent., upon what principle should the inhabitants be compelled to pay 10 per cent. to the Companies? Mr. Bateman had made a proposition that for £8,000,000 he could bring 120 million gallons of water per day from the River Vyrnwy, which ran into the Severn. There would be no necessity, however, to have a double supply, for if the reservoirs were removed into the chalk country, high levels could be obtained and pure water supplied which would need no clarifying, by being passed through sand. When water was brought to Glasgow from Loch Katrine, the Companies, which had previously asked an enormous price, were worth nothing; and he thought the London Water Companies would take warning from this fact, and offer the Metropolitan Board their mains and their pumping apparatus as old iron. He would be quite willing to come to terms with the Water Companies for the use of their apparatus when the Board obtained a new supply; but he did not think that their property ought to be estimated as worth more than an annual 5 per cent. on their capital in the presence of the competition with which the Board could threaten them.

Mr. Runtz said at the previous meeting he objected to the motion in the form in which it was then presented to the Board; but as it was now amended he could support it. He had always felt that the supply of water should be in the hands of a public body; but the Board would not be justified in taking up the question unless they were prepared to prove that the public would be benefited by their interference. He very much feared it was supposed that when the Board obtained the supply the price would be reduced; but he felt sure that such would not be the case. When they had bought the interests of the Water Companies, they would have to expend some millions more in making the supply adequate, and this would prevent the water being cheaper. Then millions more would have to be laid out in order to secure purity. There was also a great outcry against the Companies for charging on the assessment of property, because this fell very heavily upon people who were assessed at £2000 or £3000 in the City, and who only wanted sufficient water to wash their hands in two or three times a day. If the basis of charge were altered, the burden would fall on the ordinary consumer and the poor, and this also would tend to prevent a reduction in the price. The Board would never be permitted to charge by meter, because it would be a tax upon the cleanliness of the very poor—the class which it was most desired to benefit. Absolute purity, however, was pre-eminently necessary. If any important discovery had been made in the present century, it was in the direction of showing how much pure water had to do with good health. A complaint was sometimes made that the water was too hard; but there was a very simple process for making hard water soft—Clark's process. It was very economical, and it had been said by a competent authority that if proper soft water were supplied by a public body there would be a saving of three-quarters of a million a year for soap in London. The City of London had spent many thousands of pounds in putting up hydrants, which, however, proved comparatively useless, because the pressure of water could not be depended upon. If the pressure could be relied upon, and was sufficient to throw the water over the tops of the houses, a great deal would be saved in the outlay on fire-engines. The sooner the supply of such a necessary of life as water was placed in the hands of a public authority, the better for the ratepayers, because every year's delay made a difference of at least a million sterling in the cost of purchase. He thought it was the duty of the Board at once to confer with Her Majesty's Government, and impress upon them the necessity of taking immediate action.

Mr. Ewin said if the motion necessitated the expenditure of any money, he should not vote for it; if it did not, he should vote for it. If he understood the Chairman's remarks correctly, a promise had been given that no expense should be again incurred by the Board in promoting a Water Bill. He took upon himself to say that three-fourths of the parish which he at present represented were supplied with good water, and had a continuous supply night and day. Many of the houses in the district had not any tubs, butts, or cisterns; they were supplied by a pipe attached to the mains, and all the inhabitants had to do when they required water was to turn on the tap. This was at the East-End of London. He considered that if the Water Companies undertakings were bought up, and the supply controlled by a public body, such as the Metropolitan Board, the expenses would be very much augmented. Many of the houses in his district were of a very poor character, rated, perhaps, at £10 a year, and had to pay only 10s., 12s., or 14s. a year for a supply of water, while it was a well-known fact that many of the houses contained as many individuals as they were charged shillings for the water. It could not, therefore, be said the Water Company charged a heavy rate. It was the middle class in London who took up the water question and agitated for a change, because they had to pay £10, £12, or £20 a year for the water supplied to their houses. If the matter were equitably looked at, it would be seen that the Water Companies throughout the Metropolis were charging only a fair amount, and therefore there was not very much to complain about. A good deal had been said about the impurity of the water; but he thought if a public body secured the supply and gave purer water than the Companies were giving at present, the price, instead of being less, would be doubled, because the expense would be so much heavier. A fresh staff would be required, and a very large expenditure of money would be incurred over and above the cost of purchasing the present interests of the Companies.

Mr. Pocock said he was very glad to find that the last speaker lived in such a happy place, where there was a constant supply of pure water. He was sorry to say that in Bermondsey the supply was not constant, and the water was not pure; in fact, a worse and an impurer supply could not be dealt out to any parish, especially in the summer season. He therefore hoped that the motion would be carried. Mr. Runtz had alluded to the hydrants in the City of London, and said that the pressure of water was not sufficient; but he (Mr. Pocock) begged to say that the Fire Brigade Committee never met without having put before them a report of a certain number of fires that had been put out by hydrants, and even last week the hydrants proved quite sufficient to put out a large fire without the assistance of a fire-engine.

Mr. Selway, in reply, said the member who represented Bethnal Green (Mr. Ewin) had attempted to quote a statement which the Chairman had made, but did not quote it correctly. The Chairman ended by a very important qualification — namely, that the Board would not promote another Water Bill "without the consent of Her Majesty's Government." He was as familiar with the Indemnity Bill as any other member of the Board, and no one more regretted the terms in which that Bill was passed than he did. But he was perfectly conscious of what those terms were, and therefore, in the motion which he had taken the liberty of presenting to the Board, he laid great stress upon the importance of conferring with Her Majesty's Government, because he knew very well that they could not spend any money without the consent of the Government. Mr. Ewin had asked him to pledge the Board that there should be no expenditure of money. It was not for any one member to pledge his colleagues, and he could not pledge himself as to what the Committee would do. All he could say was that it would be utterly illegal for the Committee to spend any money, and he was perfectly sure the Committee would not spend any without the consent of Her Majesty's Government. The object of the amendment seemed to be that no action whatever should be taken on the part of the Board with regard to this great subject. He ventured to think that this was a conclusion which the Board would not adopt. Over and over again the Board had expressed their desire to deal with the question, and he thought they would again send it to the Works and General Purposes Committee to see if something could not be done. It was said that their action on the last occasion did not meet with any support; but the fact was that memorial after memorial was sent to them from the various Vestries in support of the action they were taking to carry out the purchase of the water undertakings. It was a measure which was popular with all the representative bodies of the Metropolis. He was not very much surprised at the opposition of the gentleman who had seconded the amendment, because at the age at which that gentleman had arrived it was probably unpleasant to him to have to deal with difficulties. He (Mr. Selway) hoped that the Board was not yet so far gone as to be unable to cope with difficulties. The honourable member for the Strand District Board of Works (Mr. Jones) had treated the matter in a manner to which great exception should be taken. He was sorry to find that on a question involving such large interests, jokes should be indulged in. When that gentleman talked of taking possession of the works and mains of the Companies at the price of old iron, it was a mode of treating the subject which the Board would not for a moment entertain. If it came to dealing with the Water Companies, they would be dealt with equitably, but not upon the basis of the Bill which was introduced by the late Home Secretary. He regarded that Bill as defunct, and he cordially concurred in the condemnation which had been heaped upon it by the various speakers. He hoped that the Committee would be able to devise some mode by which the Water Supply of the Metropolis might be placed in the hands of the Board—altered, if need be. The question of a change in the constitution of the Board should not, however, be mixed up with that of the water supply. The Board was the representative body for the Metropolis, and ought to have the control of such an undertaking. He trusted that the result of their deliberations would be that they would secure the support of Her Majesty's Government towards something being done to relieve the Metropolis from the difficulties under which it was now labouring.

The amendment was then put to a show of hands, and was lost—7 hands being held up in its favour, and 20 against it. A division being claimed, 8 members voted for it, and 23 against it.

The Board then divided upon the original motion, when 21 members voted for it, and 8 against it.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

A meeting of the Gas Committee of the Forfar Town Council was held last Wednesday, to consider the proposal to apply to Parliament for a Provisional Order to extend the Corporation's borrowing powers in respect of the gas supply undertaking. After a great deal of discussion, Bailie Laird moved that such an Order be applied for. The motion was seconded by Provost Lowson, and carried. Several members spoke against it, but they all refrained from entering any protest.

The Town Council of Falkirk held a special meeting last Thursday, when a long discussion took place in regard to the quality of the gas supplied by the Falkirk Lighting Company and the Falkirk Joint-Stock Gas Company. The Clerk submitted correspondence from the Companies, replying to a letter of his pointing out the inferior quality of the gas alleged to be supplied by them to the burgh. In the letter from the first-named Company it was stated that, as their gas was regularly tested, they were in no way afraid of losing credit through the gas being tested by the Commissioners, and were quite prepared to bear a substantial portion of the cost in the event of the Council deciding to purchase a testing apparatus. The letter went on to say that the Company invariably found that complaints about gas owed their origin to bad burners and fittings. The Joint-Stock Gas Company replied to the effect that the quality of the gas supplied by them would bear favourable comparison with that of any town in Scotland similarly situated, and where the gas was supplied at the same price. In the course of the discussion, much of which was quite irrelevant, it was suggested that, instead of getting testing apparatus of their own, as had been proposed, the Commissioners might adopt the cheaper method of testing the gas at the works of the respective Companies, where the proper instruments for so doing were being regularly employed. The discussion eventually terminated without any resolution being passed.

On Friday last an official inspection of an "Otto" gas-engine which has been brought into use for driving a fog-horn on the Island of Cumbrae, in the Firth of Clyde, took place, under the supervision of Mr. Thomas Henderson (Chairman of the Clyde Lighthouses Trust), Mr. Harvie, and Mr. Graham (Treasurer), together with Mr. D. W. Watt, of P. Watt and Son, Glasgow, by whom the engine has been erected. It had long been a serious question with the Trust as to the best means to adopt for sounding horns or bells in foggy weather, especially at the mouth of the Clyde, where fogs are so sudden, and sometimes of short duration, but yet sufficient to be dangerous to navigation at these times. The powerful horns which are now adopted as warning signals, and which can be heard at a distance of from 8 to 10 miles, require, as a necessity, to be driven by power. Steam having been tried and discarded on account of the time required to get it up, gas motors were adopted very successfully, where gas as the motive power was easily accessible; but at stations far away from gas, and on islands such as the Cumbrae, the difficulty of obtaining this motive power was felt. Now, it is hoped, this difficulty has been overcome by the adoption of a mode of producing gas in a short space of time, and of sufficient quantity to last for long periods. The gas used for this motive power, and which drives the gas-engine, is a species of hydrocarbon gas. It is a product of the manufacture of paraffin oil, and is usually known as gasoline. The apparatus used is one patented by Messrs. R. Laidlaw and Son, of Glasgow and Edinburgh.

The quality of the gas supplied in the town of Greenock may be judged of by the following report on the observations taken in the Clerk and Collector's Office during the past month, that office being well-nigh two miles from Inchgreen, where the gas-works are situated:—Durability of 4-inch flame—Minimum, 65 min.; maximum, 70 min.; average, 67·64 min. Photometer—Minimum, 27·54 candles; maximum, 32·54 candles; average, 30·16 candles. Average temperature of gas while testing, 58·04° Fahr. The number of experiments was 25. The gas supplied throughout Scotland is generally very high in its illuminating power, but there are exceedingly few cases where the average amounts to 30·16 standard candles. Aberdeen gas usually stands pretty well in this respect.

Notwithstanding the fact that there is an independent gas supply for the burgh of Milngavie, negotiations have recently been opened by the Burgh Commissioners with the Directors of the Partick, Hillhead, and Maryhill Gaslight Company, with the view of a supply being sent to certain districts situated near to Milngavie, as also to the burgh itself. Arrangements are now in progress for carrying the proposal into effect.

Some days ago the stock of the Edinburgh Gas Company stood at £45 15s. per share, but on Friday last buyers were offering only £45.

Referring to the "Note" in last week's JOURNAL regarding the water supply of Perth and the existence of typhoid fever in that town, I find that Dr. Wallace's report upon the three samples of water sent to him for analysis does not support the suspicion that the disease has had any connection with the water consumed in that town.

The Water Supply Committee of Kilwinning have entered into arrangements with a firm of contractors to connect their special water district with the Irvine main-pipe at Muirside, at a cost of nearly £1600. It is expected that the works will be completed in less than three months.

The supplementary supply of water from the Dhu Loch for the benefit of the higher levels of Rothesay was turned on last Tuesday by Provost M'Kechnie, in presence of the Magistrate and Town Council and a number of the leading inhabitants. The original surface of the water in Loch Dhu was 310 feet above Ordnance datum, or about 100 feet higher than any eminence around Rothesay, and in the scheme which has just been completed the loch has been embanked 12 feet higher than the original level, so that a supply has been obtained which is equal to 30 gallons per day to a population of 6000 persons. This supplementary scheme is expected to cost about £10,000.

With the view of considering the question of introducing an efficient water supply into the burgh, the Town Council of Wick lately appointed a Committee of their number, who have since come to a general understanding that the Loch of Yarrows is the best source from which to obtain the desired supply. On Monday, the 26th ult., that loch was visited by Mr. Gordon C.E., of Elgin, in company with the Provost and two other members of the Council. Mr. Gordon has been instructed to prepare a report on the subject, dealing with all the matters on which information may be necessary for the consideration of the Committee, and of the Town Council in its collective capacity. It is understood that Mr. Gordon thinks very highly of the quality of the water contained in the Loch of Yarrows.

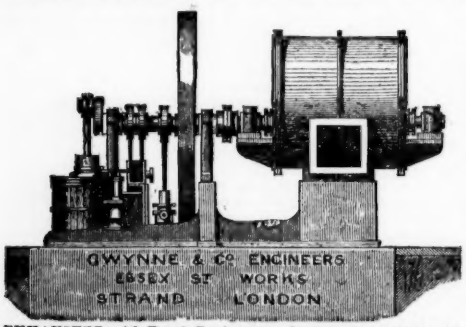
Last week's pig iron warrant market was somewhat steady, and a degree of firmness was occasionally manifested, which, however, was always followed by a relapse. As high as 48s. 6d. cash was paid on Wednesday, but the close on Friday afternoon was 47s. 3d. cash and 47s. 4½d. one month. Trade continues dull; America is not buying anything; and the Continent shows no signs of activity. These circumstances, coupled with the large production, seem to indicate that prices will soon reach a lower level.

The coal trade is exceedingly quiet. Prices are declining, and miners wages are being reduced in many cases as much as 6d. per day.

PUMPING GAS AT BECKTON.—We have been asked to mention, in reference to the large exhausters at the Beckton Gas-Works described and illustrated in the JOURNAL for the 20th ult., that each engine is controlled by two of Messrs. George Waller and Co.'s patent compensating water-balance governors, specially designed for the purpose, and made by the firm—one to prevent any risk of accident to the holder from which the gas is being taken, by stopping the engine in time; and the other to control the speed of the engine, so as to keep the gas in the delivery main at any required pressure. On the same subject, Messrs. Körting Bros. write us that, on the Continent, for several years past, their steam-jet exhauster has been employed for pumping gas direct to the consumers. They send a copy of a letter, dated Oct. 11, 1878, from Mr. E. Grahn, of Krupp's Cast-Steel Works, Essen, to Dr. N. H. Schilling, of Munich, bearing out their statement. The letter is in the following terms:—"Several inquiries having been addressed to me, lead me to make the following remarks as to a new application of the Körting steam-jet exhauster in the manufacture of gas. Last autumn an enlarged gas-main and governor, commenced for Krupp's cast-steel works, were not completed when the gas consumption increased so much that, notwithstanding the full pressure of the holders was used, it was impossible to satisfy the requirements with the old arrangements. As we could not well weight the holder, some immediate alteration was necessary. We had another bell made of zinc for the governor, and a steam-jet exhauster was fixed so as to exhaust from the holder and force into the main. After the necessary preparations the arrangement was connected and started in one day, without the least disturbance, and has since worked for nearly three months, and given every satisfaction. An increased condensation was only observed in the immediate neighbourhood of the governor-house, but still without giving any trouble; neither was there any decrease of illuminating power. The exhauster used had 12-inch pipes, and passed a maximum quantity of over 100,000 cubic feet per hour. In special cases, where the day pressure does not suffice, we apply a small exhauster to exhaust from any required part of the main, and give a greater pressure in the branch main. Although these applications may be considered as exceptional, yet, perhaps, one or other of our brother managers may make use of them in similar cases, when he may confidently rely upon good results."

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

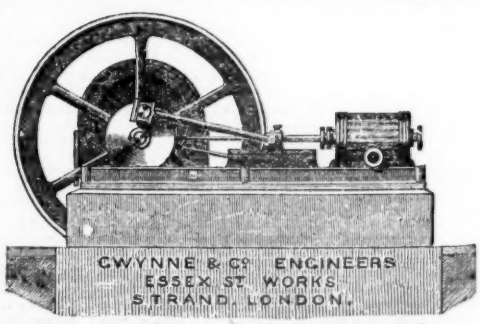
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

WANTED, Readers of the NEW Edition, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, MAGNUS OHREN, Assoc.M.I.C.E., Gas-Works, SYDENHAM.

WANTED, by a Young Man (married), a Situation as MAIN and SERVICE LAYER. Is used to Gas-Works. Can Fix and Read Indexes of Meters. Is the son of a Manager, and has had some experience in an Engineer's shop, both at Lathe and Vice. Very steady.
Apply to the MANAGER, Gas-Works, Crayford, KENT.

WANTED immediately, a Working FOREMAN, competent to perform any of the duties connected with a small Gas-Works, and to take charge in the absence of the Manager.
Apply, stating age, references, and qualifications, to Mr. G. SMEDLEY, Gas-Works, BUXTON.

WANTED, for the Whittlesey Gas-Works, a WORKING MANAGER. He must thoroughly understand the management of a small Gas-Works, Fitting-up House Services, Main Laying, and Meter Registers. State references, and where last employed; also salary required.
Apply to JAMES W. REEVE, Secretary, Whittlesey, near Peterborough.
Whittlesey, April 28, 1880.

A VACANCY occurs in the Office of a small Provincial Gas-Works for a YOUTH. A good opportunity of learning routine management.
Address No. 655, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

TO ENGINEERS AND MANAGERS OF GAS-WORKS.

WANTED, good Second-hand Gas Plant as under:—
Two 12 ft. by 4 ft. by 4 ft. Cast-Iron Tar Tanks, complete.
One 4-in. Tar Pump.
One 8-in. Annular or Square Condenser, with Upright Inlet and Outlet Pipes, Bye-pass Valves, &c., complete.
One 8-in. Governor (latest improved), Bye-pass Valves, &c., complete.
105 9-ft. Lengths 8-in. Socket and Spigot Pipes.
Six 5-ft. Lengths, Spigot ends only.
Six 8-in. Flange and Spigot T's.
One 12-in. Rack and Pinion Valve.
One Purifier, 14 ft. by 7 ft., Wood Sieves, &c., complete, with 8-in. Inlet and Outlet Well Pipes.
Retort Mouthpieces, D's, 18 in. by 13 in., Cross-bars and Lids, 6 in. by 4 in. Ascension-Pipes, 4-in. Saddle-Pipes, 4-in. Dip-Pipes.
State price per ton delivered into trucks at nearest Railway Station.
Apply to J. T. KENDLE, Metropolitan Hotel, Finsbury Circus, LONDON.
April 22, 1880.

A BARGAIN.

FOR SALE—Seven New Iron Retorts, 7 ft. 6 in., 13 by 12½.
Apply to J. LINFORD, Manager, Gas Company, St. Neots, HUNTS.

FOR SALE.—A Set of Four Purifiers, with Centre-Valve, in one frame, measuring over all 12 feet, with Sieves complete. Covers to above nearly new. The whole having been replaced by larger.
Apply to R. J. SHARMAN, Manager, Gas-Works, WISBECH.

FOR SALE—A Set of Four Purifiers, 10 ft. square by 4 ft. 6 in. deep, with Hydraulic Centre-Valve and 10-in. Connections; One Scrubber; Condensers; a Beale's Exhauster; and Two Steam Boilers, Hydraulic Main, Ascension, and Bridge Pipes, all of which may be inspected on application to
JOS. TIMMINS, Engineer, &c.
Gas-Works, Leigh, Lancs.

THREE SECOND-HAND PURIFIERS FOR SALE.

THE Richmond (Surrey) Gas Company have for Sale Three PURIFIERS, 12 ft. by 12 ft. by 3 ft. 6 in., which have been taken down to make room for larger ones. They are in good condition, and will be sold cheap.
All particulars may be obtained from the undersigned,
JAMES ELDRIDGE, Engineer, &c.

SUNDRY PLANT for Immediate Sale:—
Two Cast-Iron Superheaters (Binnie).
One Wrought-iron Coffey's Still or Washer, 10 ft. by 2 ft. by 1 ft.
One 3-Horse Portable Engine and Boiler, by Sykes, nearly new.
One 20-Horse Cornish Boiler, Easton and Anderson's make, 1873, with Fittings complete.
One 10 ft. square Purifier, with Lifting Gear.
Two 2 ft. Gauges, on Board.
One Wheel Hoist
A quantity of 4 in. Hot Water Pipes and Connections.
For particulars, and to view, apply to CHAS. E. BOTLEY, Great Western Railway Locomotive Department, Gas-Works, Wormwood Scrubbs, Kensal Town, W.; or to the Secretary of the New Gas Company, Limited, 16, George Street, Mansion House, LONDON, E.C.

THE Broadstairs Gas Company have for SALE—
One 6-in. Station Governor.
Two 7 ft. 6 in. Lengths of 15-in. Round Hydraulic Main.
One 15-in. Round Mouthpiece.
Fifteen 14-in. Round Mouthpieces.
Fifteen 4-in. Ascension-Pipes.
Fifteen 4-in. H-Pipes.
Fifteen 4-in. Dip-Pipes.
Nineteen Round Retort-Lids.
Fifteen Retort Screws.
All in good condition. Removed to make room for larger.
For particulars and price, apply to
W. J. LATCHFORD, Manager.
Gas-Works, Broadstairs, April 27, 1880.

GAS PLANT FOR SALE.

THE Coventry Gas Company have for SALE—
SCRUBBERS.—One 5 ft. 6 in. diameter, 20 ft. high. One 5 ft. 6 in. diameter, 15 ft. high. One 5 ft. diameter, 20 ft. high; with or without 8-in. Connections and Valves.
GASHOLDER.—One Telescopic, 40 ft. diameter and 34 ft. high, in two lifts; Cast-iron Tank for same, 41 ft. 6 in. diameter, 18 ft. high.
STEAM-JET VENTILATOR.—One No. 2 Körting's Patent Jet Ventilator, with Chest. One No. 3½ Körting's Patent Jet Blower.
VALVE.—One 12-in. Cathels's Four-way Valve.
The above are being replaced by larger apparatus, and can be removed at once. Also a 100-light Gas Apparatus (Porter's make); this includes a Gasholder, 14 ft. diameter and 10 ft. high, which could be sold separately.
For particulars and prices apply to
W. L. ROBINSON, Manager.
Gas-Works, Coventry, April 17, 1880.

THE Sheffield United Gaslight Company OFFER for SALE the following lots of Retort-House FITTINGS, which they are now taking down at two of their Stations:—
54 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft. 6 in. by 18 in. by 18 in.
16 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft. 6 in. by 18 in. by 15 in.
4 Pieces Cast-Iron Hydraulic Main, U-shaped, 9 ft. 6 in. by 16 in. by 15 in.
320 Cast-Iron Mouthpieces, D-shaped, 21 in. by 15 in.
160 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 7 ft. 6 in. long.
215 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 5 ft. 6 in. long.
50 Lengths 4-in. Cast-Iron Ascension-Pipes, curved, 5 ft. 6 in. long.
60 Lengths 4-in. Cast-Iron Ascension-Pipes, curved, 2 ft. 8 in.
37 Lengths 4-in. Cast-Iron Ascension-Pipes, curved, 10 ft. 2 in.
40 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 5 ft. 10 in.
17 Lengths 4-in. Cast-Iron Ascension-Pipes, straight, 5 ft. 5 in.
481 Lengths 4-in. Cast-Iron H-Pipes.
506 Lengths 4-in. Cast-Iron Dip-Pipes.
The above apparatus has been in use up to a recent date, and is adapted for re-erection.
The Company will be prepared to receive an offer for the whole or any portion of the above. Price £4 per ton, loaded into trucks at Sheffield.
Applications to be addressed to the undersigned.
THOS. ROBERTS, Manager.
Gas Office, Sheffield, March 25, 1880.

ON SALE—A Station-Meter, in good condition, capable of passing 8000 feet per hour. Inlet and outlet, 8 in. diameter.
Apply to Mr. LONGWORTH, Gas Offices, GUILDFORD.

GAS PLANT FOR SALE.

THE Maidstone Gas Company having enlarged their Works, offer the following Apparatus for Sale in good condition:—
SCRUBBERS.—One Tower Scrubber 30 ft. high by 10 ft. diameter, with Distributor, and partly fitted with Livesey's boards.
CONDENSERS.—One Set of Annular Condensers, consisting of 9 Pipes 17 ft. high, outer diameter 2 ft. 6 in., fitted with 12-in. Valves complete.
ENGINES.—Two 12-Horse Power Horizontal Engines in very good condition.
STATION-METERS.—One Station-Meter, with Valves and Bye-pass for 20,000 per hour, in ornamental case (Milne); one Station-Meter, with Valves and Bye-pass for 6000 per hour, in cylindrical case.
HYDRAULIC MAIN.—Six 8 ft. by 18 in. Hydraulic Main D wrought iron; 24 8 ft. 9 in. by 18 in. Hydraulic Main D wrought iron. Nearly new.
BRIDGE AND ASCENSION PIPES.—90 6 in. by 4 in. Bridge-Pipes, and a quantity of 6-in. Ascension-Pipes and Bends.
For further particulars and price apply to
JOHN WEST, Engineer and Manager.
Gas Works, Maidstone, April 21, 1880.

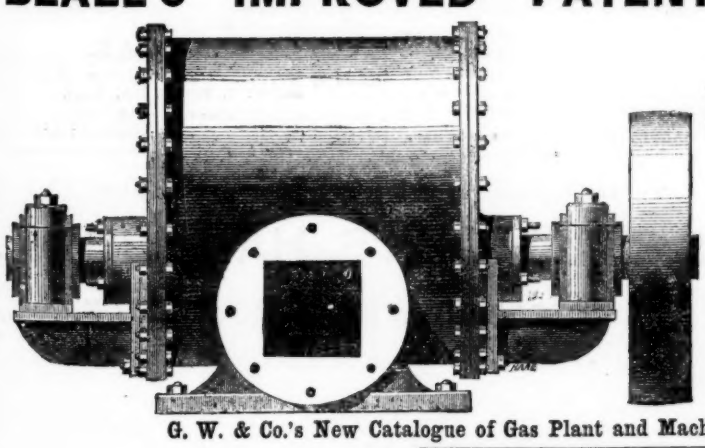
THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—
About 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12-in. Slide-Valves and 12-in. Connections.
Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12-in. Connections.
Exhauster (Jones) to pass about 15,000 feet per hour.
Exhauster (Beales) to pass about 25,000 feet per hour.
Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.
Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.
4-horse power Horizontal Steam-Engine.
Three 4-in. Pumps, with cranked Shafting and a pair of Mitre Wheels.
Two Purifiers, 16 ft. by 8 ft., with six 12-in. Slide-Valves and 12-in. Connections.
Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.
Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.
Gasholder, Double Lift, capacity 100,000 feet.
Gasholder, Double Lift, capacity 240,000 feet.
One 12-in. Governor, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.
Two 12-in. four-way faced Valves, by Cockey.
For further information, &c., apply to the undersigned.
R. MORLAND, Engineer.

TO COAL PROPRIETORS.

THE Directors of the Cheltenham Gas-light and Coke Company invite TENDERS for the Supply of the best quality of COAL for making gas, for One, Two, or Three Years, from the 1st of July next.
For quantities, particulars, and conditions of contract, application to be made to the Company's Engineer.
Sealed tenders, addressed to the undersigned, must be forwarded on or before Thursday, the 20th of May.
The Directors do not bind themselves to accept the lowest or any tender.
R. O. PATTERSON, Engineer.
Gas-Works, Cheltenham, April 26, 1880.

THE Salford Corporation Gas Com-mittee invite TENDERS for about 150 tons of SPENT OXIDE, lying at the Lamb Lane Gas-Works.
The Engineer will supply samples from the bulk, or an analysis, on application.
Tenders, on form to be obtained from Mr. S. Hunter, the Engineer, Lamb Lane, Salford, must be delivered to me on or before the 11th of May next.
The Committee do not bind themselves to accept the highest or any tender.
By order.
CHRIS. MOORHOUSE, Town Clerk.
Town Hall, Salford, April 30, 1880.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,



WITH OR WITHOUT
WROUGHT-IRON SPINDLES AND
ENGINES COMBINED.

GEORGE WALLER & CO.,
MAKERS OF
ENGINES, EXHAUSTERS,
INDEX AND DISC GAS-VALVES,
HYDRAULIC MAIN VALVES,
BYE-PASS VALVES,
TAR, LIQUOR, AND OTHER PUMPS,
SCRUBBERS AND PURIFIERS,
CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

PHŒNIX ENGINEERING WORKS:
HOLLAND STREET, SOUTHWARK, S.E.

BAHIA GAS COMPANY, LIMITED.

NOTICE is hereby given that the ORDINARY HALF-YEARLY GENERAL MEETING of this Company will be held at the Company's Office, Nos. 7 and 8, Idol Lane, London, on THURSDAY, the 20th day of May, 1880, to receive the Report of the Directors, the Balance-Sheet confirmed by the Auditors, and for general purposes.

The chair will be taken at Three o'clock precisely.

By order of the Board,
ALFRED J. HEAD, Secretary.

April 22, 1880.

WHITSTABLE GAS COMPANY.

THE Directors of the Whitstable Gas Company invite TENDERS for the Supply and Erection of a new GASHOLDER, 48 ft. diameter and 18 ft. deep.

Particulars of which may be obtained by application to R. DARNEY, FAVERSHAM.

FOLKESTONE GAS-WORKS.

THE Directors of the Folkestone Gas and Coke Company are prepared to receive TENDERS for the construction of a RETORT-HOUSE, Engine and Boiler House, Coal Stores, and other Buildings, to be erected at their Gas-Works at Folkestone.

Drawings and specification may be inspected, and forms of tender and schedules of quantities may be obtained on application at the Office of the Company at Folkestone, and at the Office of Messrs. Thomas and Charles Hawksley, Civil Engineers, 30, Great George Street, Westminster, S.W., on and after Tuesday, the 4th day of May next; and tenders must be delivered at the Office of the Company at or before 10 o'clock in the forenoon of Friday, the 21st day of May next.

The Company do not pledge themselves to accept the lowest or any tender.

WILLIAM MEDHURST, Jun., Secretary.

Folkestone, April 26, 1880.

CANNEL AND COAL.

THE Joint Gas Committee of the Dukinfield, Denton, and Haughton Local Boards require TENDERS for CANNEL and COAL, in quantities not exceeding 2000 tons, for One or more Years, commencing on July 1 next.

The Cannel to be round or mixed, and the Coal to be of the best quality and well screened. Offers for any other descriptions will not be considered. Tenders to state the name of the Coal, also from what pit, and if it is to be delivered at the Gas-Works, Dukinfield, or at the Dog Lane Siding, M. S. and L. Railway. The weight to be in tons of 2240 lbs.

The Committee will not be bound to accept any tender.

Tenders, endorsed "Coal," to be here by Wednesday, the 12th of May.

HARRISON VERVERS, Engineer, &c.

Gas Offices, Dukinfield, April 26, 1880.

SECOND-HAND ENGINES, EXHAUSTERS, BOILERS, &c.

THE Scarborough Gas Company invite OFFERS for the Purchase of their present Duplicate Exhausting Machinery, comprising Two 7-in. Cylinder by 14-in. Stroke Horizontal Steam-Engines; Two 20,000 cubic feet per hour Gwynne and Beale's Patent Exhausters; Two Hydraulic Governors in Connection with Throttle Valves of Engines; and Two Cornish Boilers, 11 ft. by 3 ft. 9 in.

The whole are of superior make and have been carefully used, and are well worth attention, being about to be removed for replacement by larger and more powerful apparatus.

The machinery may be seen in operation until the 30th of April, and further particulars may be obtained on application to the undersigned.

By order,
WILLIAM J. MOON, Manager.

Scarborough, March 5, 1880.

TO COLLIERY OWNERS.

THE Corporation of the Borough of Dewsbury hereby invite TENDERS for the Supply and Delivery of the following quantities of the best GAS COAL and CANNEL:—

12,000 Tons Gas Coal
1,000 Tons Cannel

The Coal is to be well screened and dressed, free from scales, sulphurous pyrites, or other objectionable matter. Deliveries to be made in such quantities and at such times as the Manager may direct, from July 1, 1880, to June 30, 1881. The Coal to be delivered at the Savile Town works, or (if sent by boat) to be delivered into boxes ready for hoisting by the steam crane.

The Corporation do not bind themselves to accept the lowest or any tender.

The Contractors to state in the tender the seam and the pit from which he intends to send the Coal.

Sealed tenders, endorsed "Tenders for Coal," to be sent to Jesse Smith, Esq., Town Clerk, Dewsbury, not later than noon of Wednesday, the 26th day of May.

Further particulars and forms of tender may be had on application to the undersigned.

C. ARMITAGE, Engineer and Manager.

Gas-Works, Savile Town, Dewsbury.

THE SHREWSBURY GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the Shrewsbury Gas-light Company invite TENDERS for the Supply of Best GAS COAL, to be delivered free at the Great Western or London and North-Western Goods Yard, Shrewsbury, during the three years commencing on June 1, 1880, at such times and in such quantities as may be from time to time required by the Company's Manager.

The Coals are to be well screened, free from bats, bind, or other refuse, and to be freshly got.

About 24,000 tons will be required under the contract.

The Directors reserve to themselves the right to divide the quantity into two or more contracts, and do not bind themselves to accept the lowest or any tender.

Payments—monthly, net.

Tenders to state what allowance per ton will be made for the Company's waggons (the right to run which is to be at the option of the Directors), and also to state what seam the coal offered is to be got from.

Tenders to be sent to the undersigned on or before May 24, 1880.

By order,
WM. BELTON, Secretary and Manager.

Gas-Works, Shrewsbury, April 30, 1880.

IMPERIAL CONTINENTAL GAS ASSOCIATION.

INCORPORATED BY ACT OF PARLIAMENT.

NOTICE is hereby given that the HALF-YEARLY ORDINARY MEETING of the Proprietors of the Imperial Continental Gas Association will be held at the City Terminus Hotel, Cannon Street, London, on Monday, the 24th inst., at Two o'clock in the Afternoon precisely, when a report will be made to the Proprietors, a dividend declared for the half year ended Dec. 31, 1879, and the usual ordinary business of such meeting transacted.

Notice is hereby given that the transfer books will be CLOSED on Monday, the 10th inst., and will remain closed until after the Half-Yearly Ordinary Meeting on the 24th inst.

By order of the Board,
R. S. GARDINER, Secretary.

No. 30, Clement's Lane, Lombard Street, London, E.C., May 1, 1880.

TO COAL MERCHANTS.

THE Directors of the Horsham Gas Company, Limited, in Sussex, invite TENDERS for a Supply of COAL from the present time till Midsummer, 1881.

The whole quantity required is expected to be from 2000 to 2500 tons, to be delivered, carriage paid, at the Horsham Railway Station, as may be ordered.

The Coals to be either Pelaw Main, New Peltons, or Holmeside.

Sealed tenders, endorsed "Tender for Coals," to be sent to the undersigned, before 8 p.m. on Monday, May 10.

ROBERT SHEPPARD, Secretary.

THE Directors of the Exeter Gaslight and Coke Company are prepared to receive TENDERS for the Supply and Erection of CONDENSERS at their Basin Gas-Works.

Plans, specification, and conditions of the same may be seen on application to the Engineer, at the Basin Works: and sealed tenders, endorsed "Tender for Condensers," to be sent to me, the undersigned, on or before Monday, May 17, 1880.

The Directors do not bind themselves to accept the lowest or any tender, nor will they pay for estimates.

By order,
W. A. PADFIELD, Secretary.

April 27, 1880.

THE Buxton Local Board invite Tenders for the Supply of GAS COAL and CANNEL for One or more years, at the rate of from 1000 to 1200 tons per annum of each.

The whole to be screened free from Bats, Dirt, or Pyrites to the satisfaction of the Manager of the Gas-Works, and to be delivered at the Gas-Works siding, Ashwood Dale, Buxton, in quantities and at times as he may direct.

Tenders, endorsed "Tender for Coal" or "Cannel," addressed to the Chairman of the Gas Committee, to be forwarded not later than 3 p.m. on Friday, the 14th inst.

The Board is not bound to accept the lowest or any tender.

Any other information required may be obtained on application to the Manager at the Gas-Works.

By order of the Board.
JOSIAH TAYLOR, Clerk.

May 1, 1880.

TO GAS COMPANIES AND CORPORATIONS.

MEASURING DIAPHRAGMS, Shafts, Bearings, Spindles, Wheels, and every requisite for repairing WET and DRY METERS on their Works, supplied by W. TELLING, Gas-Meter Manufacturer, 119, Barnsbury Road, LONDON, N.

GEORGE E. TOURNAY,

CONTRACTOR FOR THE ERECTION AND REBUILDING OF RETORT-BENCHES, CHIMNEY SHAFTS, &c.

RETORT SETTING A SPÉCIALITÉ.

References to large and small Works.

ADDRESS: WINCHEAP, CANTERBURY.

ERECTION of CHEMICAL PLANT.

SPECIALITIES.

LIQUOR AMMONIA APPARATUS, GAS LIQUOR, URINE, &c.
GREAT IMPROVEMENT IN PLANT.

SULPHATE OF AMMONIA APPARATUS.
Continuous Method.
IMPROVED "COFFEY STILL" PROCESS, &c.

APPARATUS FOR MAKING AMMONIACAL LIQUOR FROM NITROGENOUS MATTERS.

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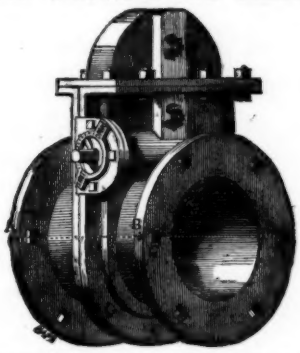

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Abstract of Analyses made by Dr. WALLACE, Gas Analyst for the City of Glasgow.

	Cubic Feet per Ton.		Illuminating Power.		Equivalent of a Ton in Sperm.
Plesio Boghead	13,165	....	36·16	....	1632
Brown Capledrae	12,210	....	38·46	....	1610

WILLIAM SUGG'S
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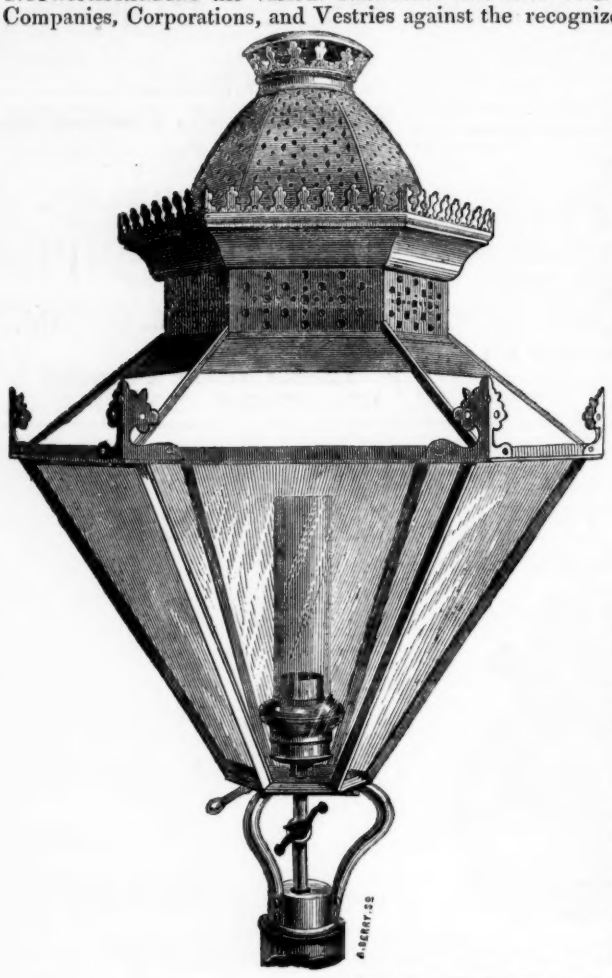
SUITABLE FOR CANNEL OR COMMON GAS.

NEW PATTERN LANTERN for "LONDON" ARGAND BURNERS of 50 to 400 Candle Illuminating Power, as supplied to the Metropolitan Railway Stations.

NOTWITHSTANDING the various statements that have been assiduously circulated of late, tending to prejudice Public Companies, Corporations, and Vestries against the recognized superiority of my large Argand Burners (established by tests made by eminent scientists, and confirmed by testimonials received from numerous Engineers of Gas-Works, which have appeared from time to time in the Advertisements of the JOURNAL), **the Highest Results** obtained at the recent trial of large Burners for Street Illumination held at Birmingham—where the most complete collection of large Burners and Lanterns extant had been assembled—were produced by the **200-candle and other large Argand Burners of my make**; clearly substantiating the statement I have repeatedly published, that the **Sugg Burners give over 30 per cent. Illuminating Power more than can be obtained from any other Burners with the like quantity and quality of Gas.**



It remains, moreover, to be mentioned that at the same trial my **Flat-Flame Burner,** with patent circular slit (patented 1875), produced the highest result in illuminating power of all the competitive Flat-Flame Burners present.

Amongst other places, the Burners and Lanterns have been adopted at—

PETERBOROUGH	DONCASTER	GREAT GRIMSBY
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Extract from the JOURNAL OF GAS LIGHTING, *&c., March* 16, 1880.

EXPERIMENTS IN IMPROVED STREET-LIGHTING AT BIRMINGHAM.

PUBLIC TRIAL, WEDNESDAY, MARCH 10, 1880.

After a prolonged inspection of the various Lanterns and Burners, tests were made by a shadow meter between Sugg's 200-candle Argand (No. 9), Bray's 200-candle Quadruple Bat's-wing (No. 10), and the Burner and Lantern as used by the Paris Gas Company in the Rue du Quatre Septembre (No. 12), with the results as shown in diagram, fig. 2. These appear to agree pretty nearly with the photometrical results obtained from each Burner, as shown in the preceding table (Mr. Hunt's Experiments, see page 404 of JOURNAL, March, 1880.)

PHOTOMETRICAL TRIALS.

No. 9. *Sugg's 200-Candle Argand Opal Top, Consumption per hour 44 cub. ft.*	*No. 10.* *Bray's 200-Candle Quadruple Bat's-wing, Consumption per hour 50 cub. ft.*	*No. 12.* *Burner and Lantern used by the Paris Gas Company in the Rue du Quatre Septembre, Consumption per hour 32 cub. ft.*
Light equal. 79·5 ft.	70·5 ft.	85 ft. *Light equal.* 65 ft.
150 ft.	150 ft.	

FIG. 2.

NOTE.—The Lights were fixed on Posts in the manner they are used in the Public Streets.

THE RESULTS WORK OUT AS FOLLOWS:—

No. 9.	**No. 10.**	**No. 12.**
27 per cent. better than No. 10. **= 191·7 Candles.** **Add 24·0 Candles for the extra 6 feet of gas required to equal the consumption of No. 10.**	**= 151 Candles, or 8 per cent. better than No. 12.**	**= 92·8 Candles.** **If the consumption had been 50 ft., the Illuminating Power would have been at the same rate—138 Candles.**

Total 215·7 Candles, or 42 per cent. better than No. 10 for the same quantity of gas.

The next best on the List is Sugg's 100-candle Argand Burner, as fixed on the Refuges in the districts of the Phœnix Gas Company, London Gas Company, Commercial Gas, and Gaslight and Coke Company. They have been, moreover, definitely adopted by the Vestries of Lambeth, St. George's, St. Mary's (Rotherhithe), Lewisham Board of Works, St. Giles's Board of Works, as well as the Great Eastern, Great Northern, London, Brighton, and South Coast, and Metropolitan Railways.

The fact that over 1200 of these large Burners and Lanterns have been supplied to almost every Gas Company or Municipal Authority in England alone, within a very short time, speaks significantly of the excellence of this system, and the real merits it has been proved to possess.

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(7 gallons or 1 cwt. will cover 1211 square yards of ironwork.)
Is cheaper and more economical than any other.

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SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

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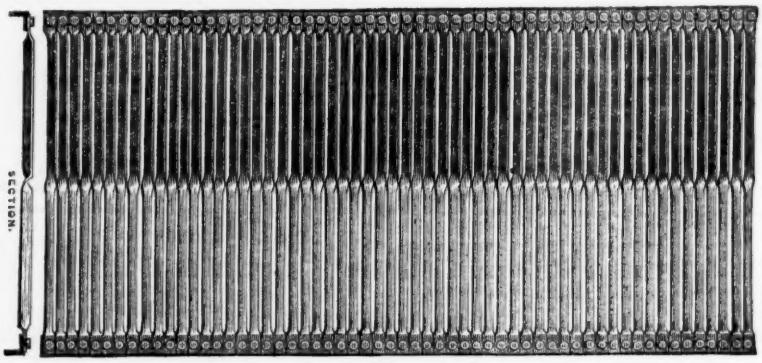
S. C. and SONS supply *every* requisite for Gas-Works, and keep in stock Small Articles, such as BARROWS, SCOOPS, RETORT-LIDS, BOLTS, &c.; and they manufacture WOOD SIEVES of a very superior description.



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Are the very best possible as PURIFIER VALVES; leakage impossible, most easy to work, never get out of order or the worse for wear, and can, if desired, be very simply arranged to work the whole or a part of a set of Purifiers in any conceivable order whatever. Have already been erected and approved at the London Gas-Works, Nine Elms; Phœnix Gas-Works, Greenwich; Maidstone, Ipswich, &c.
Full Particulars on Application.

CUTLER'S PATENT SIEVES
Are the most durable. The sieve bars presenting an inclined plane to the flow of the Gas, offer the least possible resistance, greatly reducing pressure, and permitting contact with every part of the purifying material. Have been supplied to many of the London and Provincial Gas-Works, and give great satisfaction.

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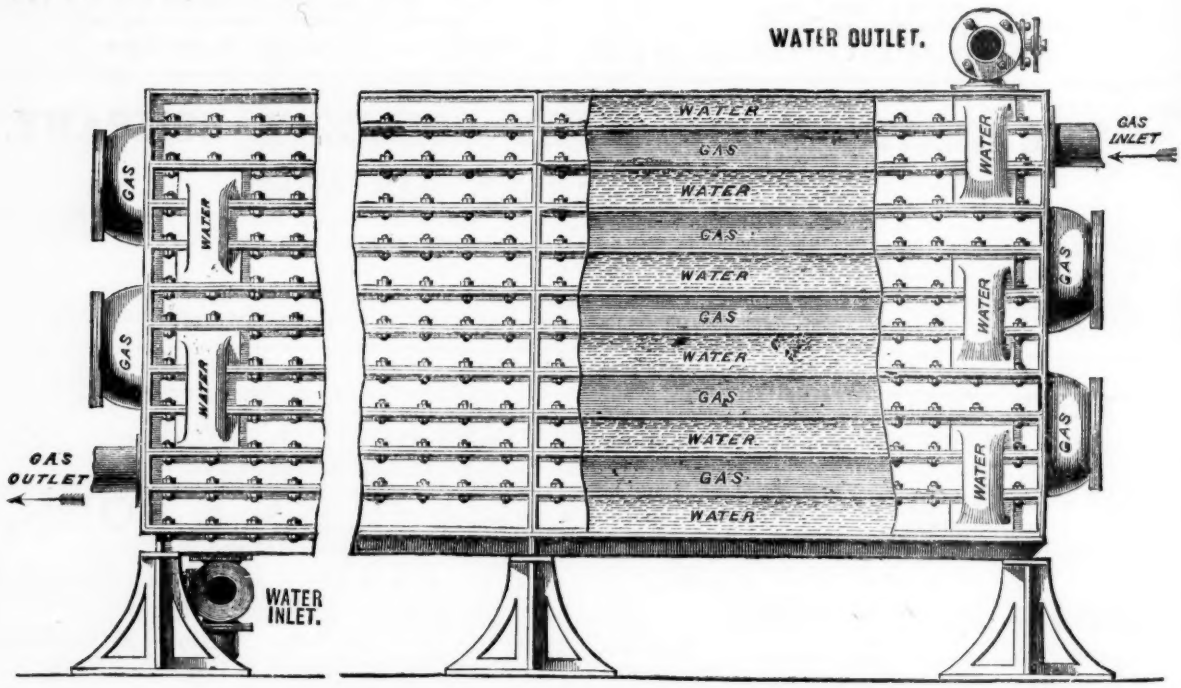
Adopt water as a cooling medium, the respective streams flowing in opposite directions; quantity of water required but small, and being only raised in temperature, is useful for any purpose of the works. The power of Condensers can be regulated at will by the amount of water permitted to pass through. Erected and giving great satisfaction at Brentford, Tunbridge Wells, Maidstone, Buxton, Phœnix Gas-Works, Greenwich; where its advantages may be seen.

Mr. WATES, of Greenwich, has kindly offered to reply to any inquiries addressed to him as to its efficiency.



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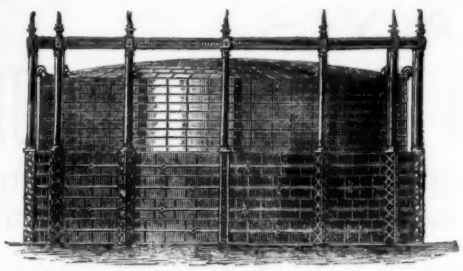

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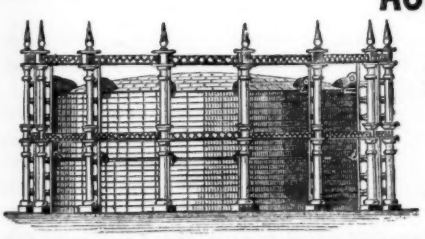

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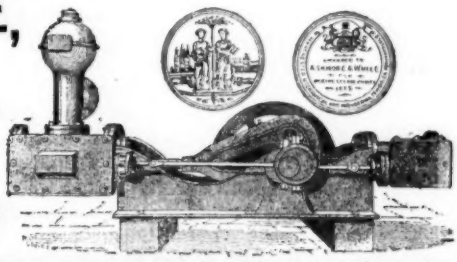

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Sperm Candles no longer absolutely necessary as Standards of Illuminating Power, for by

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The Illuminating Power of Lighting Gas can be accurately ascertained by means of the Gas whose value is sought.

F. W. HARTLEY has made some hundreds of experiments during several months past, and has, in conjunction with Mr. METHVEN, established a Standard equal to the light of Two Average Standard Sperm Candles.

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And, "in actual use," yields as much light with Common Gas, and more light with Cannel Gas, than any Argand System.

IMPORTANT NOTICE.

HAVING some time ago dealt with Mr. Sugg's statement that his Street-Lighting Apparatus yielded "over 30 per cent." more light "over all others" in the market, in a manner that caused its prompt withdrawal, we had hoped that the necessity would not have again risen to defend ourselves against statements calculated to mislead Lighting Authorities and the Public.

At the exhibition of gas-lamps, recently held at Birmingham, an error in Mr. Sugg's favour—admitted to be such by the Experimenters, and known to be such by all those who have had to do with making comparative tests with these Lanterns—having been made in the test with the 200-candle power Lantern, it has been extensively advertised without the correction accompanying it in Mr. Hunt's report.

A correct estimate of Mr. Sugg's fresh advertisement will be gathered from the following facts, which he has been careful NOT to publish:—

1. Mr. Sugg has NOT noticed Bray's 80-candle high lighting power Flat-flame, which Mr. Hunt tested along with the other burners we sent, and which Mr. Sugg knows to have yielded 3·51 candles per foot; and he has omitted to state that this is a higher result than that produced by either of his 80-candle Argands, which was 3·26 and 3·41 candles per foot respectively; and this without deducting the 40 per cent. that the Argand necessarily loses "in actual use" (*see paragraph* 5). A large proportion of the street-lighting apparatus sent out by Mr. Sugg are 80-candle power, and have been freely advertised as yielding "over 30 per cent. more light than all others," &c.
2. Mr. Sugg does NOT state that all Bray's burners, with which he compares his own in his advertisement, are of "**medium** lighting power," known to be such by the Birmingham authorities, and by Mr. Sugg, and distinctly stated to be such in all our lamp sheets. Therefore, in comparing his **high** lighting power with our **medium** lighting power burner, without stating the fact, he takes an unfair advantage of a competitor, and the public are deceived.
3. Mr. Sugg does NOT point out that there is but one (and that the least used) of the Argands which he names which shows a superiority of even 12 per cent. over Bray's above mentioned 80-candle power burner, and this should be corrected *as per paragraph* 5.
4. Mr. Sugg does NOT mention that the Flat-flame Burners he exhibited were beaten by Bray's 80-candle power Flat-flame to the extent of 8 per cent. in one test, and 12 per cent. in another, but he distinctly states that his Flat-flame Burners "produced the highest result in illuminating power of all Flat-flame Burners present."
5. Nor does Mr. Sugg draw attention to the fact that the Argand cannot be made to yield "in actual use" the light it shows when tested by the ordinary photometer, which is the same in principle as that adopted at Birmingham. We state—and our utmost effort has not availed us to get Mr. Sugg to contest the points with us—that the lack of top and bottom light (as compared with the Flat-flame) reduces the total all-round yield by about 20 per cent.; and that the Argand burner cannot be governed, "in actual use," to yield within 10 per cent. of its best, because of the liability of the flame to smoke with the slightest increase of pressure when working to its full capacity. And a further deduction of 10 per cent. must be made because of the chimney becoming rapidly dirty, and permanently opaque by use, if it does not happen to break.
6. Mr. Sugg also OMITS to mention that the Lantern in which his 200-candle power burner was tested was NOT the Sugg "Shadowless," of which there have been so many sold, but one designed by Mr. Hunt, which yields a much greater amount of light.
7. And while Mr. Sugg gives prominence to a result, admitted to be erroneous by the Experimenters (and has not accepted our offer to make another test with the same lamps), he entirely omits to mention the correction which accompanied the report from which he professes to quote. This correction showed that, when both apparatus were rated to consume exactly 46·75 feet of gas per hour, the lights were equal when the shadow meter was 73 feet 2 inches from Bray's Flat-flame Lantern, and 76 feet 10 inches from Hunt's Improvement on the Sugg Argand Lantern; this showing a difference of only 3 feet 8 inches; and from this result allowance must be made for the defects of the Argand when "in actual use," *as per paragraph* 5.

In view of the above, a proper estimate will be placed on Mr. Sugg's recent declaration that he "will have nothing to do with challenges," but "will continue to give, as he has always done, correct information of the results to be obtained from his burners and lanterns."

Extract from the *Leeds Mercury*, April 1, 1880.

At the meeting of the Leeds Town Council, March 31, Alderman Gaunt moved that the Council approve of the acceptance by the Corporate Property Committee of the tender of Messrs. Geo. Bray and Co. for the supply of 21 new lamps, to be placed upon the pillars round the Town Hall. The Committee had tested Sugg's and other lamps, and found Messrs. Bray's the best. It was intended to have two 200-candles power and two 100-candles power, and 17 round the hall of 80-candles power. Mr. Lynd, in seconding the motion, said that he had had an opportunity of seeing different lamps tested at Birmingham, and he was in favour of Messrs. Bray's.

Extract from the *Daily Free Press*, Aberdeen, Jan. 1, 1880.

Judging of the merits of the lights as they appeared last night, on-lookers seemed to be generally of opinion that between Sugg's patent and Bray's larger light at the corner of Union Buildings, Castle Street, there was no perceptible difference in the illuminating power. When the vital question of gas consumption is taken into account, it is found that in the Castle Street lamps there is a marked difference in the quantity of gas consumed, for while 30 feet of gas are hourly burned in Sugg's Patent Lamp, only 20 feet are used by Bray's Lamp during the same period.

[**The above Lamps have Meters attached.**]

Bray's Lanterns have been adopted by the Vestry of St. George's (which includes "WESTMINSTER"), Hanover Square, London, for all the crossings and refuges of that important district, after a direct competition with the Argand system of lighting; and also by about 40 Towns and Vestries, after a similar competition in most cases.

GEORGE BRAY & CO., BLACKMAN LANE, LEEDS.

F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

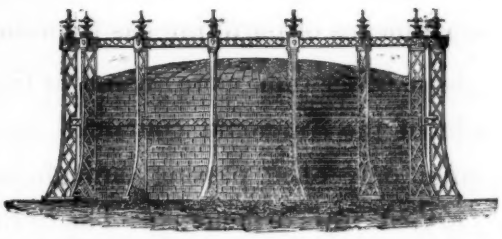
BROAD STREET, BIRMINGHAM.

ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS, WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED, LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

HYDRAULIC, GAS, AND GENERAL ENGINEERS,

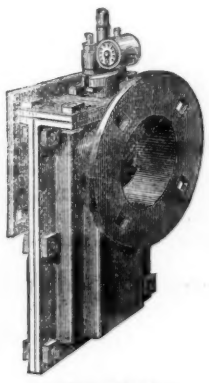
WHITEFRIARS STREET, LONDON, E.C.

Sole Manufacturers of MANN & OWENS'

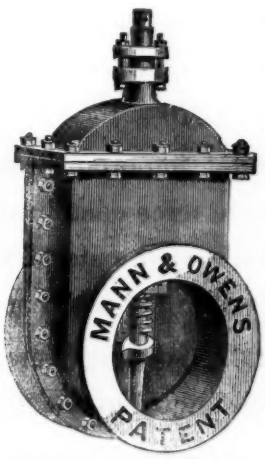
PATENT SCREW & CAM GAS-VALVE,

Protected by Royal Letters Patent in England, France, Belgium, & the United States of America.

VALVE to OPEN DOWNWARDS.



BRIDGE-VALVE
for Regulating the Seal of Hydraulic Mains.



VALVE to OPEN UPWARDS.

The SPECIAL ADVANTAGES of MANN AND OWENS' PATENT VALVE are as follows:—

1. Its non-liability to become set fast through varying temperature or from the deposit from crude gas. 2. It is made absolutely gas-tight by the simple action of a screw and cam. 3. Inconvenience through the breakage of springs or wedges setting fast cannot arise. 4. The face of the Valve is scraped and cleaned of any solid matter at each operation of opening or closing.

The Valve can be had to work either in a Vertical or Horizontal position.

Every Valve is carefully tested under pressure, and warranted perfectly sound and gas-tight.

INSTRUCTIONS FOR ORDERING.

State whether required for above or below ground, if Double Flange or Socket and Spigot Valves are wanted, or with loose Flanged Socket and Spigot pieces.

The Prices include Indicators to show extent to which Valve is open.

Also makers of PILLAR-VALVES, SELF-ACTING BYE-PASS VALVES, OUTSIDE RACK AND PINION VALVES, HYDRAULIC-MAIN VALVES, DISC-VALVES, &c.

Every description of Pumping Apparatus, Hydraulic Lifts, &c., suitable for use in Gas-Works, made to order.

PRICES, SIZES, AND FULL PARTICULARS, WITH COMPLETE ILLUSTRATED CATALOGUE, FURNISHED ON APPLICATION.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

SCOTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

MEMORANDUM FOR GAS COMPANIES.

TORBAY AND DART PAINT COMPANY, LIMITED,

SOLE PROPRIETORS AND MANUFACTURERS OF

WOLSTON'S

TORBAY PAINTS.

OFFICES:

23, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.

WORKS:

DARTMOUTH AND BRIXHAM, DEVON.

TRADE MARK

These celebrated Paints are now very generally acknowledged to be the best and most economical in use. GAS COMPANIES especially have, by experience, proved that no others so fully meet their peculiar requirements, as they are not only UNAFFECTED BY GREAT HEAT and EFFECTUALLY RESIST SULPHURETTED HYDROGEN, AMMONIA, &c., &c., but they may be applied to GASHOLDERS that have hitherto been covered with the unsightly coal tar.

They are also cheaper than other paints and compositions; TWO COATS OF GENUINE WOLSTON'S TORBAY PAINT BEING EQUAL IN COVERING POWER TO THREE OF LEAD PAINT, or any of the numerous low-priced spurious oxides that are now in the market, whilst the durability of Wolston's is unrivalled.

The colours most approved for GASHOLDERS, PURIFIERS, SCRUBBERS, and all the plant and machinery used in and about Gas-Works, are—

FOR DARK TINTS.

No.	p. Cwt.	No.	p. Cwt.
13. Torbay Red	34s.	8. Bronze Green	36s.
6. Dart Brown	34s.	16. Torbay Chocolate	34s.
10. Carriage Red	34s.	4. Brixham Black	32s.
1. Torbay Brown	30s.		

FOR LIGHT TINTS.

No.	p. Cwt.	No.	p. Cwt.
7. Imperial Stone	34s.	19. Light Stone	36s.
29. Portland Stone	38s.	30. Bath Stone	38s.
31. Gray Stone	38s.	38. Buff	35s.

These Prices are for Paints in paste, carriage paid to any Gas-Works in Great Britain, in consignments of not less than 5 cwt.; but all the above colours may be had, READY MIXED FOR THE BRUSH, IN VARIOUS SIZED PAINT CANS WITH HANDLES, AT A UNIFORM PRICE OF 56s. PER CWT. (6d. PER LB.) carriage paid as above, in consignments of not less than 2 cwt., the sizes being 3 lb., 7 lb., 14 lb., and 28 lb. By taking the Paints in this convenient form, a considerable saving is effected in time, &c., as they can be immediately applied by any workman without the intervention of skilled painters to mix and prepare them; besides which all waste is avoided, and they may always be relied on as containing no adulterating or inferior material.

Where light colours are preferred, the work should be primed with two coats of No. 7, and finished with either of the other stone colours; and when the darker colours are selected, a priming coat of No. 13 is recommended.

Specimen Cards forwarded and Inquiries attended to on application to

23, GREAT GEORGE STREET, WESTMINSTER, LONDON.

THE

MANN & WALKERS' PATENT SCRUBBER.

Extensive use.

The successful and extensive use of the Mann and Walkers' Patent Scrubbers in all parts of the world has demonstrated their advantages, and entitled them to be received with credit and confidence. The number of them in use is about twenty times that of any other known means of purifying gas from ammonia.

Small quantity of Water required.

By a very small quantity of clean water (not more than 5 or 6 gallons per ton of coals carbonized) the whole of the Ammonia contained in the Gas is completely absorbed; the Gas, after only once passing through, issuing from the Scrubber outlet completely purified from Ammonia. The Scrubber gives no appreciable back pressure.

Residual Product obtained.

The Residual Product—namely, the Ammoniacal Liquor—is obtained at from 20 to 30 ounces commercial strength, which enables it, after being mixed with the weaker Liquor from the hydraulic main and condensers, to be sold to the Manufacturing Chemists, or converted into Sulphate, at the degree of strength found most profitable to the Gas Company.

Illuminating power increased.

The Scrubber is a Saturator, and the Gas being soaked in this strong solution of Ammonia in the lower columns of the Scrubber, is purified from a large amount of Carbonic Acid, and its Illuminating Power is thereby increased.

Small amount of power required.

The friction is so little, and the motion so slow, that the power necessary to work the Scrubber is almost inappreciable. A small gas-engine will work a pair of Scrubbers, purifying 2 million cubic feet of gas per day.

Beckton Gas-Works.

There are thirty of these Patent Scrubbers in the Beckton Gas-Works, equal to purifying 30 million cubic feet per day, and the total amount of engine power necessary to work the whole 30 is not equal to that given out by one 10-horse engine.

Reserve purifying power contained.

There is also a most important advantage arising from the height of these Scrubbers, in the reserve force contained in them. In the event of any stoppage, the mass of soaked and wetted material would continue the purification for hours, even if the supply of water and working were stopped from any cause.

Internal Materials not changed.

The changing of the soaking materials in these Scrubbers is very seldom required; they are well known to remain in action for seven years without being emptied.

Guarantee.

They are in all cases erected under guarantees; they easily fulfil the stipulations of any Act of Parliament, and the chemical restrictions of the Board of Trade; and in cost they are much less to a Gas Company than any other known means of purifying Gas from Ammonia.

C. & W. WALKER.

8, *Finsbury Circus, London, E.C.*

THE

"WARNER & COWAN" METER.

THIS Meter stands alone and unrivalled, as the only thoroughly reliable, and continuously accurate, measurer of gas.

The drum is properly described as "self-regulating," its construction being such that it maintains practical uniformity of discharge per revolution throughout all changes of water-line.

All other Wet Meters either vary with a varying water-line (because their drums are *not* self-regulating), or are complicated by "compensating" arrangements in the futile and *now wholly superfluous attempt* to make the water-line unvarying.

Loss of water by evaporation or otherwise, neglect to supply it at the proper time, or to the correct degree (so necessary for the registration of other Meters), produces no change in the measurement of the WARNER & COWAN. Even in the extreme case of a prolonged neglect to water leading to the extinction of the lights, nothing but inconvenience would arise; whereas with an ordinary Wet Meter this inconvenience would, in such a case, not only occur (and much sooner, because of the shorter range of float), but would be preceded by a considerable alteration of capacity, and therefore incorrect registration.

"Compensating" Meters, depending as they all do upon complex arrangements (extraneous to the drum), for maintaining the water-line, are not only inadequate to the duty, but unreliable in action.

The drum of a Meter being the measurer, ought to be *in itself* a true and unvarying measure. This, the WARNER & COWAN drum *alone* is.

W. & B. COWAN,

(ESTABLISHED 1827,)

WET & DRY GAS-METER MANUFACTURERS,

Sole Licensees and Manufacturers of

THE AUTOMATIC PRESSURE CHANGER,

[WM. COWAN'S PATENT.]

CHURCH ST., MILLBANK ST., *LONDON, S.W.* | DUTTON ST., NEW BRIDGE ST., *MANCHESTER.* | BUCCLEUCH ST. WORKS, *EDINBURGH.*

ROBERT MARSHALL,

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198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

HARTHILL CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND Co., 21, Lime Street, LONDON, E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

GAS COAL.

THE Tawd Vale Colliery Company, Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete Analysis, on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.

Mr. James Paterson, C.E., F.G.S., in his analysis of T. V. Arley Coal, says: "Some parts merge into a semi-Cannel; gas per ton, 10,300 cubic feet; illuminating power, 16·96 candles; coke of high quality, 1431 lbs. per ton."

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SILICA FIRE-BRICK CO.,

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Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

BIRTLEY IRON WORKS,

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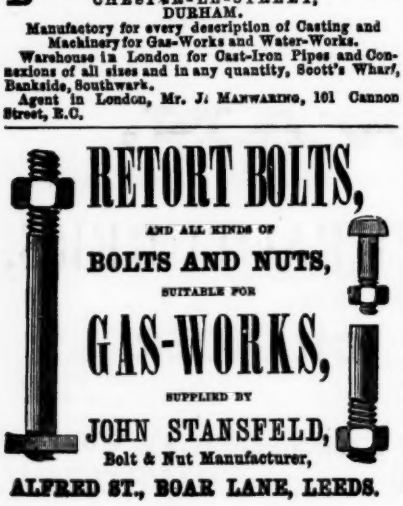
Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 101 Cannon Street, E.C.



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BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS,

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AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

THE

THAMES BANK IRON COMPANY,

OLD BARGE WHARF, UPPER GROUND STREET, LONDON, S.E.,

SUPPLY FROM STOCK

CAST-IRON RETORTS AND ALL KINDS OF GAS-WORKS APPARATUS,

SOCKET-PIPES FOR GAS OR WATER PURPOSES,

FLANGE-PIPES FOR STEAM,

RAIN-WATER PIPES AND GUTTERS,

HOT-WATER BOILERS, PIPES, AND CONNECTIONS,

LAMP-COLUMNS, LAMPS, LAMP-FRAMES, WROUGHT TUBES, &c.,

HOT WATER AND HOT AIR APPARATUS,

Erected complete on the most Improved Principles.

REGISTERED.

TRADE MARK.

"VICTORIA,"

The Cheapest and Best

LEATHER BELTING

IN LONDON.

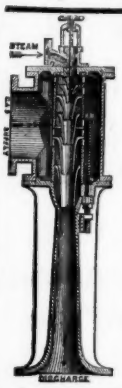
The Leather is of the Best Possible Quality, and English Oak Tanned.

Sample Orders of over £5, Carriage Paid to nearest Railway Station.

PRICES AND TESTIMONIALS ON APPLICATION TO

J. C. R. OKES,

39, QUEEN VICTORIA STREET, LONDON, E.C.



KÖRTING'S STEAM-JET EXHAUSTER,

IMPROVED CLELAND'S PATENT.

UPWARDS OF 400 IN USE.

CLELAND'S PATENT SLOW-SPEED CONDENSER, AND CLELAND'S PATENT STEAM SCRUBBER.

FOR PARTICULARS, APPLY TO

KÖRTING BROS.,

17, LANCASTER AVENUE, MANCHESTER,

OR TO

GERALD J. TUPP, Creek Engine-Works,

Middle Mall, Hammersmith, London, W.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Twenty-Eight Illustrations and Letterpress, on the Construction of Gas-Works, will be sent, post free, on receipt of 4s. in stamps To be had of the AUTHOR; or at the Office of the "JOURNAL OF GAS LIGHTING."

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

ANTI-CORRODO TUBES
(BARFF'S RUSTLESS PROCESS)

See Professor FOSTER'S *Article on "The Corrosion of Iron" in* JOURNAL *of March* 30, 1880.

THE RUSTLESS AND GENERAL IRON COMPANY
(JAMES E. AND SAMUEL SPENCER),
Makers of ANTI-CORRODO (BARFF'S) TUBES AND FITTINGS
For Gas, Steam, and Water; also Black Galvanized and Enamelled.

WORKS: West Bromwich. *Quotations and Pamphlet on application to* 97, CANNON STREET, LONDON, E.C. LIVERPOOL OFFICE: 34, Moorfields.

LONDONDERRY GAS COALS
DIRECT FROM THE
MARQUESS OF LONDONDERRY'S COLLIERIES.
COUNTY OF DURHAM.

For Prices and Particulars, apply to
MR. S. J. DITCHFIELD,
LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.
London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

JOHN HALL AND CO., STOURBRIDGE,
Manufacturers of FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.
13-A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

Price's Patent Lamplighters Tell-Tale,
OR TIME RECORDER.

This Instrument has been invented particularly for recording the hours of starting and return of Lamplighters from the Works, or any office, for the discharge of the duties of lighting and extinguishing Public Lamps; but it is also applicable to any establishment in which it is desired to obtain an unfailing record of the attendance or non-attendance of men at their posts at certain periods. Irregularity in the time of lighting Public Lamps leads to complaints, while neglect in extinguishing at the proper hour causes loss to Gas Companies, or where the average meter system is in use, an excess of expenditure on the part of Local Authorities.

SOLE MANUFACTURERS,
ALEXANDER WRIGHT & CO.,
55, 55a, and 56, MILLBANK STREET, LONDON, S.W.

T. NEWBIGGING,
CONSULTING GAS NGINEER,
5, NORFOLK STREET, MANCHESTER.

HENRY LYON,
MECHANICAL AND CONSULTING GAS ENGINEER,
NORWOOD, NORTHENDEN ROAD,
SALE, NEAR MANCHESTER.

SANDELL AND SON,
PUBLIC ACCOUNTANTS,
2, GREAT GEORGE STREET, WESTMINSTER.
SANDELL AND SON having been engaged during the past 25 years in Gas Companies Accounts, either in Preparing or Investigating Statements for Parliamentary Applications, Arbitrations, and otherwise, offer with confidence their Services for similar purposes.

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Manufacturers of all Descriptions of
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ESTABLISHED 1836.
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GAS AND WATER PIPES.
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CAST-IRON GAS AND WATER PIPES.

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Prices on application.

THE PORTER-CLARK PROCESS
FOR THE
SOFTENING AND FILTRATION OF WATER IN LARGE QUANTITIES, WITHIN SMALL SPACE, AT SMALL COST.
(*See* JOURNAL *of Jan.* 6, 1880.)

In an article upon the Swindon Water Supply, the *Wilts and Gloucestershire Standard* of Aug. 9, 1879, says:—
"All praise is due to the Company who have thus provided a water supply that, if it can be equalled, we are safe in saying cannot be surpassed. . . . For the information of all caterers for public health, we explain that the mode of so effectually Purifying and softening the really good and naturally wholesome water is the 'PORTER-CLARK PROCESS.' 'CLARK'S PROCESS' was known to be chemically admirable; the improvements, however, effected by Mr. Porter, mechanically, are curious as they are perfect."

The filtration is exquisite, and everything arrested is removed daily.

The Visiting Justices of the Kent County Asylum at Chartham on Aug. 29, 1879—
Resolved, "That a favourable testimonial be given to Mr. Porter for his system down to the present time, and that the Clerk forward a copy of this resolution to Mr. Porter." (50,000 gallons daily.)

The Visiting Justices of the Middlesex County Asylum, Banstead Downs, under date of Sept. 12, 1879—
Certify, "That up to the present time the 'PORTER-CLARK WATER-SOFTENING PROCESS,' which has been in operation at this Asylum for about two years, has satisfactorily answered the purposes for which it was intended." (60,000 gallons daily.)
(See *The Times*, Aug. 23, 1877, Paper by Mr. F. J. Bramwell, F.R.S., Meeting of British Association, Plymouth.)

The Proprietor of the *Daily Chronicle* and *Lloyd's Weekly News* writes, Sept. 17, 1879—
"The 'PORTER-CLARK WATER-SOFTENING PROCESS,' erected by you at my paper-mill at Sittingbourne, continues to give satisfaction, and I no longer have any trouble with my steam-boilers. I am not yet working the filters up to their full capacity, only softening about 80,000 gallons per 24 hours, whereas I could easily do more than 120,000 gallons. I may add that it only requires one man to attend to the whole operation."

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CROLL'S
DRY GAS-METERS,

PRIZE MEDALS.

LONDON, 1851;
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(INVENTED & PATENTED IN 1844,)

COMBINING ALL THE LATEST IMPROVEMENTS,

MANUFACTURED ONLY BY

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238, KINGSLAND ROAD, LONDON, N.E.

CIRCULAR TO GAS COMPANIES AND OTHERS.

Stourbridge, Jan., 1880.

DEAR SIRS,—As the time for ordering stock for your general requirements for this year is approaching, we beg to call your attention to the various articles of our manufacture, and to solicit your early commands.

Fire-Clay Gas-Retorts.—As some of our friends appear to prefer these *machine made*, we have arranged to supply machine-made Retorts at same price as hand-made ones. At the same time, although it is to our advantage to supply machine-made, we do not recommend them, for the reason stated to you in our Circular of November, 1878. We have a very large stock of Retorts, all in good condition, and of such an assortment that we could supply any size on receipt of order.

Fire-Bricks and Fire-Clay Settings of all Shapes and Sizes.—We have a large and varied stock, or could make to special design at short notice.

Staffordshire Blue Bricks and Paving Bricks.—We shall be glad to submit prices and samples of these on hearing from you, with specification, and we venture to say our brand in these goods is unsurpassed. Hard Blue Paving Quarries make the best kind of Pavement for Retort-Houses, &c.

Coloured and White Glazed Bricks, Porcelain Baths, Kitchen Sinks, Corner Sinks, &c., we are making a great speciality of, and have no hesitation in saying that our glazed goods are unequalled for soundness of manufacture and purity of colour.

Earthenware Drain-Pipes, Cast-Iron Pipes, Wrought-Iron Tubing.—We should be glad of an opportunity of quoting you for these when you are in the market.

Lime, Cement, Plaster of Paris.—Our Lime Kilns at Brettell Lane are now in full operation, and we are in a position to supply any quantity of pure Lime manufactured only from the Earl of Dudley's best Limestone Beds. Our Cements and Plaster of Paris will withstand any required test.

References and Testimonials.—We can furnish you with any number of these; and may mention that during the last thirty-five years we supplied most of the Gas-Works in the United Kingdom and Abroad, and that we have held contracts from Her Majesty's Government for more than Twenty years consecutively.

Awaiting your esteemed favours,

We remain, Dear Sirs, your obedient servants,

HARRIS & PEARSON.

Note.—We shall be pleased to furnish Drawings and Specifications, if desired, and shall be most happy to see you or any of your Engineers here at any time; or, if you would like to see any of our representatives or ourselves at your Works, shall be glad to wait upon you by appointment.

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SOLE MAKERS OF

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Constructed on the principle of the ordinary Plug-Cock.

THROUGH-WAY & FOUR-WAY COCKS

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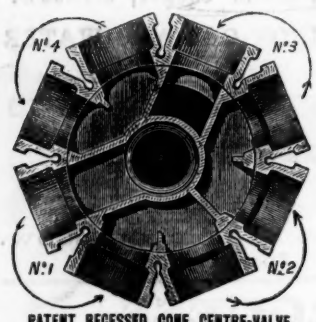

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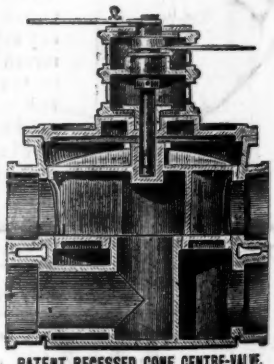
Sectional Plan.



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PATENT STREET LAMPS,

Which are so constructed that neither putty nor other materials are required to secure the glass. No hacking out of old putty, which frequently destroys the frames. A new pane of glass can be inserted in two or three minutes by any inexperienced person, the glass being secured by a hinged flap and turn button.

PRICE, with Opaline Reflecting Top, 12s.; with Fluted Glass Top, 10s. 6d.
Also made EXTRA STOUT recommended for its durability.

D. HULETT'S IMPROVED SERVICE CLEANSER,

By the use of which stoppages in service and other pipes are freed from naphthaline and other obstructions in a few minutes. PRICE 73s. net.

HULETT'S PATENT MERCURIAL REGULATOR,

For inserting in mains, to prevent the excess of pressure in high ground, or other elevated positions.

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